Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

July 1949
TECHNOLOGY DEPARTMENT
PUBLIC LIBRARY
JUL 1949
DETROIT

SEEING BEES WITH EASE

Versatile 'Perspex' plays yet another part! In the Stanley Observatory Hive its lightness, strength and transparency are utilised to provide a hygienic home for bees where they can be watched without being worried. This is a practical help for student apiarists, and agricultural colleges.

'PERSPEX' ACRYLIC SHEET

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED

P.331

ERINOID LIMITED

Manufacturers of Modern Plastics Materials

LIGHTPILL MILLS, STROUD, GLOUCESTERSHIRE. Tel: STROUD 810 (5 lines)

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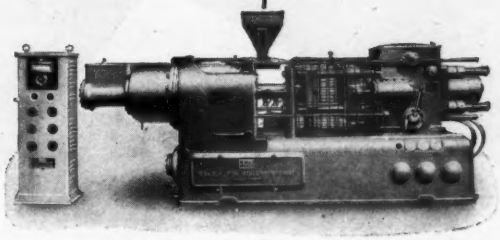

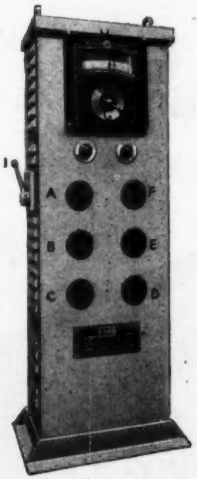

A .. Control dial
B .. Rear heater dial
C .. Rear centre heater dial
D .. Front centre heater dial
E .. Front heater dial
F .. Nozzle heater dial
G .. Selector dial
H .. Red pointer adjustment
I .. Isolator switch

Automatic Temperature Control

Cylinder has a large heating capacity with 5 A.C. heating units. Heater switching control for maintaining working temperature is entirely automatic When first switched on *all* heaters automatically give full capacity. When working temperature is reached they are automatically switched to proportional heating as set by dial for various positions along cylinder. At maximum working temperature heaters are switched off automatically and switched on again when temperature falls.

FMB

Patent No. 9B INJECTION MOULDER

FEATURES

- Temperature automatically controlled
- Controllable heating zone
- Single handle operation
- Interlocked handle gives correct sequence
- Timed injection cycle prevents "scamped" mouldings
- Dies have 136 tons direct lock—no toggles to wear or jam
- Automatic attachment available as an extra
- Interlocked sliding gate guard
- All air cylinders and rams are hard chromium plated

CAPACITY

Plasticising capacity :—
4 oz. cyl. : 34 lb/hr cell. acet.
2 oz. cyl. : 26 lb/hr cell. acet.
Distance between bars 11¾" × 10"
Max. and min. die thickness 12"-2"
Movement of die platens 7¾"
Max. area of work at 7 tons/sq. in. : 36 sq. in.
Locking force 136 tons
Injection pressure :
4 oz cyl. : 7·6 tons/sq. in.
2 oz cyl. : 11·9 tons/sq. in.

E. M. B. Co. Ltd.

WEST BROMWICH — ENGLAND

Issued by Thos. Firth and John Brown Ltd., SHEFFIELD

How high is extra high?

The difference between "high" and "extra high" shock-resistance of phenolic moulding materials is measured in impact strengths. Figures are: 0.9 ft./lbs. for high and 2.7 ft./lbs. for extra high shock-resistance. "Extra" represents, therefore, an upgrading in strength of 200%. To the moulder this means the difference between a moulded article moderately proof against rough handling in normal use, and one which will stand really hard knocks, prolonged vibration, or even dropping.

Rockite 3932 is extra high shock-resisting phenolic moulding material.

Trays moulded in Rockite 3932 drop 12 ft. on concrete without shattering. Rockite 3932 is, therefore, the inevitable phenolic material for moulded table tops, trays, textile accessories, instrument cases, and tool handles. Ask BRP for samples and information

BRP

BRITISH RESIN PRODUCTS LTD.

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"Rockite" is a Registered Trade Mark.

Preheating of Plastics by
INFRA-RED LAMPS
G.E.C. Infra-Red Lamp Heating is being used with marked success in the manufacture of plastic moulded products of all kinds.
In the rapid and uniform softening of plastic sheet and strip or for the drying of plastic powder prior to moulding or punching, Infra-Red Heating has a definite contribution to make to the speed and efficiency of your production line.
FOR ALL INFRA-RED HEATING CONSULT THE
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Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2

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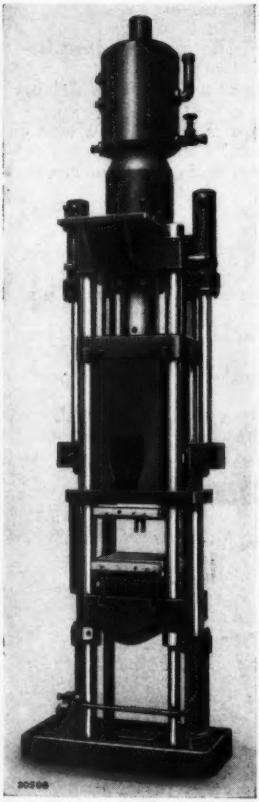

DANIELS

50-TON SPECIAL DOWN-STROKE PREFILLING MOULDING TRANSFER PRESS

Double-acting type, with 8" diam. main ram providing 50 tons mould locking pressure. Two 3" diam. Injection Rams fitted to a special rack and pinion guided crosshead, carrying a 2" diam. injection plunger exerting an injection pressure of 14 tons. Automatic prefilling, piston-type control gear, electric platens with Cambridge Thermostats built-in electraulic sustained pressure pump, with electrics for 380/420 volts, 3-phase, 50 cycles, A.C. supply.

Detailed specification with general arrangement drawing sent on request.

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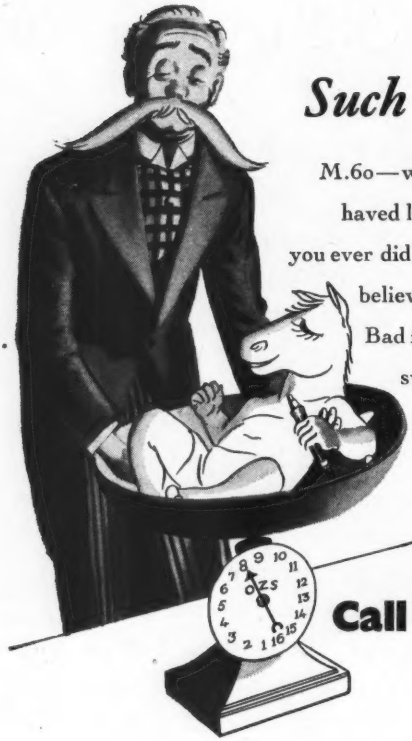

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M.60—we call him, the quietest, best behaved little darling of a baby screwdriver you ever did see. And quick! Well you won't believe it but he revolves at 14,000 r.p.m. Bad for him? Not a bit, dearie, the little sweet stays as cool as a cucumber. Never tires, never complains. Like to hold him? Well so you shall, dearie! Just send us a postcard to say you're interested.

Call up the little

teeny-weeny

horse

THE DESOUTTER MINIATURE SCREWDRIVER weighs 8 ounces. Size: 5½" long by ⅞" diameter. Capacity: Screws, No. 3 to 10 BA, and equivalent nuts. Operation: The air is automatically switched on when the tool is applied to the head of the screw and pressed on to the work. The tool can quickly be reversed by turning the ring switch fitted in the head of the tool. The impact clutch of new design gives perfect torque selection when used with pressure regulator on the air line.

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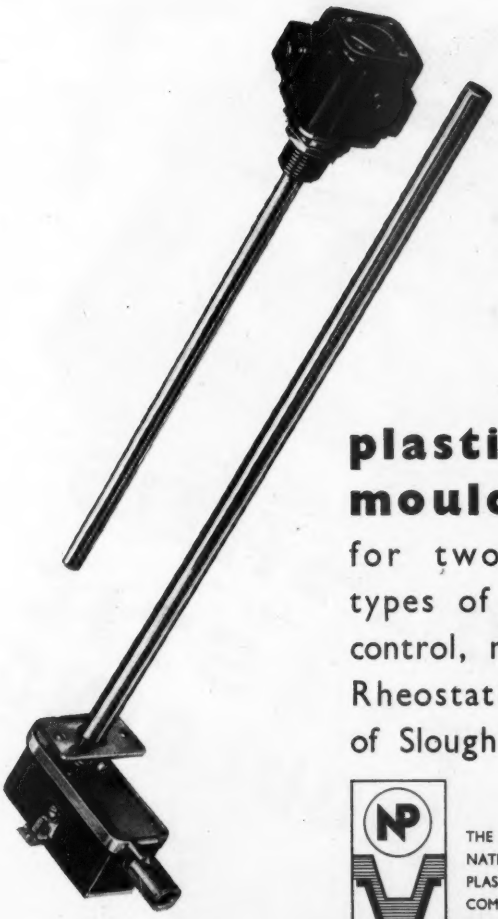

plastic mouldings...

for two different types of thermostat control, made for the Rheostatic Co. Ltd. of Slough by . . .

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MOULDED PRODUCTS LTD. . . *Birmingham*

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MP109

DIE STEELS *for* PLASTIC MOULDING

The ESC folder, reference PLM.1/2, contains details of steels eminently suitable for present needs.

New steels, however, are being designed to meet the special problems arising out of the rapid development in the Plastics Industry.

ENGLISH STEEL CORPORATION LIMITED

OPENSHAW MANCHESTER 11

Fablon

P.V.C. SHEETING SETS ENTIRELY NEW STANDARDS

"Fablon" marks the biggest step forward in sheeting standards . . . greater tensile strength, better welding characteristics, flexibility in cold temperatures, colours fast to light, excellent adhesion to design after printing. "Fablon" is produced on plant in advance of any other in this country—is perfectly calendered and made with the highest grade plasticisers.

Examine—and compare—the superb finish, drape, suppleness and "feel." "FABLON" is supplied in frosted finish in natural and pastel shades, all normal thicknesses, widths up to 54", in transparent, opaque and metallic sheeting.

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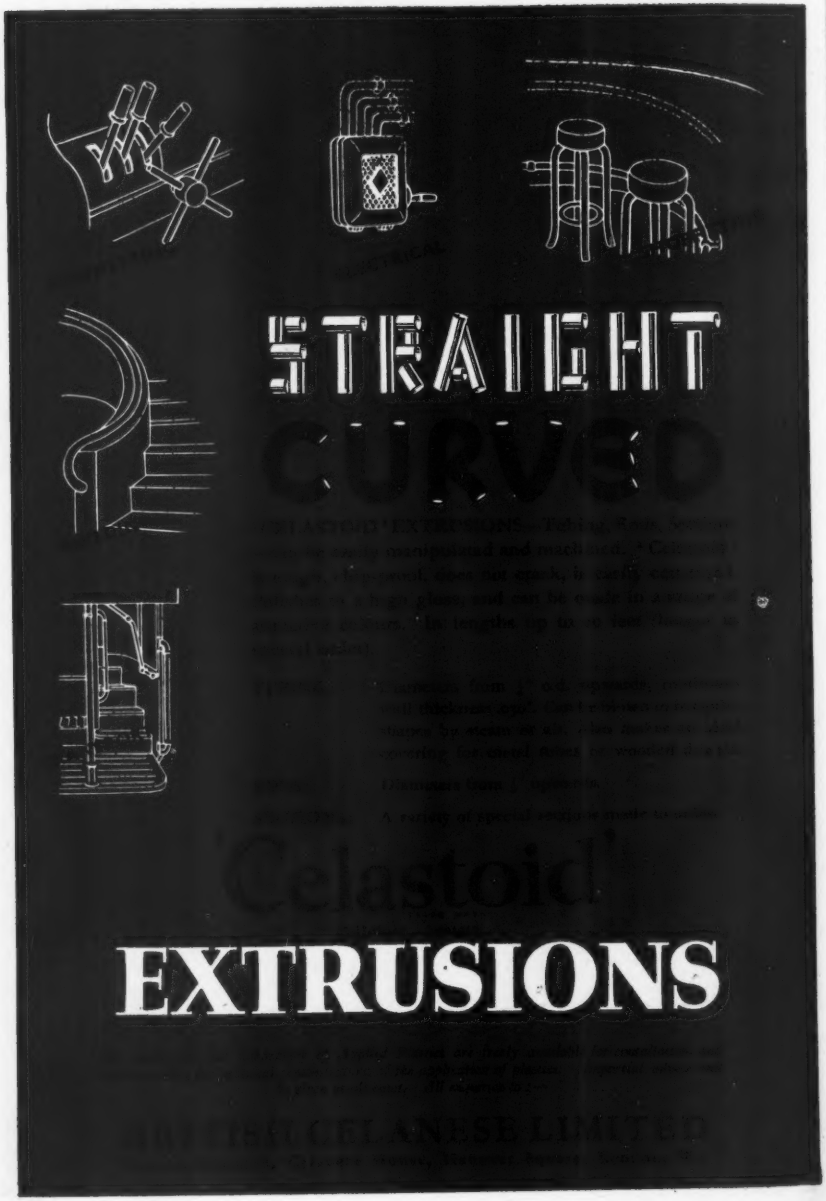
B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M&B CHEMICALS *for* INDUSTRY

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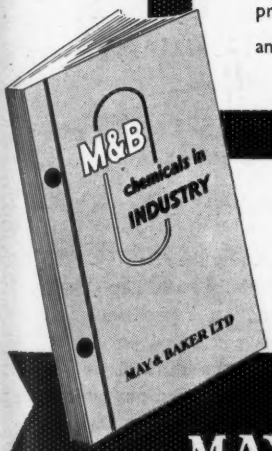
for the production of a pearl effect in plastic material

Pearl Paste has been used with particular success in conjunction with casein plastics. Approximately 5 per cent. in the form of a homogeneous cream, to which the desired dyestuff has been added, is mixed with the dry casein prior to extrusion in the form of rods, which are subsequently compressed into sheets under the influence of pressure and heat.



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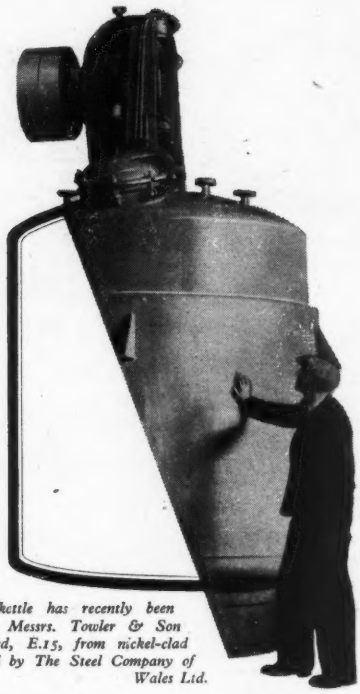


This agitator kettle has recently been constructed by Messrs. Towler & Son Ltd., Stratford, E.15, from nickel-clad steel provided by The Steel Company of Wales Ltd.

NICKEL-CLAD STEEL

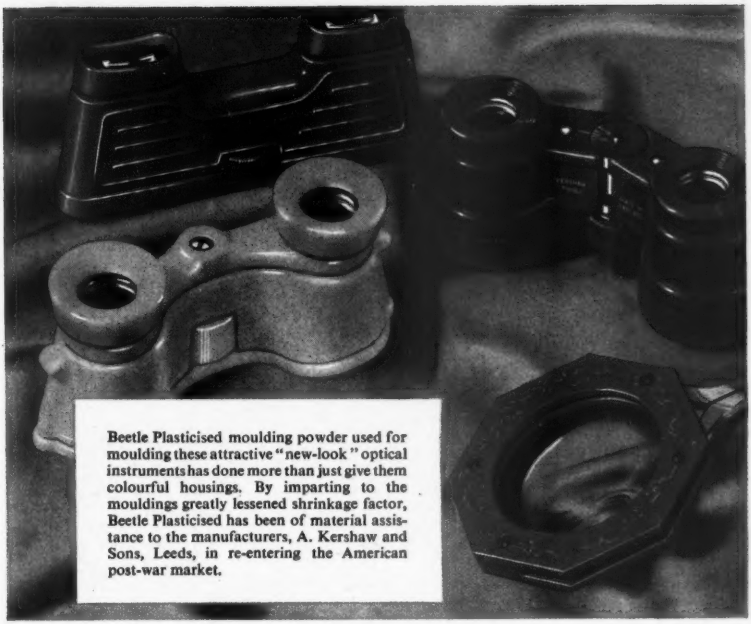
PUTS NICKEL WHERE IT'S WANTED

Cost has frequently prohibited chemical manufacturers from utilising the corrosion-resisting properties of pure nickel for large equipment. With the availability of nickel-clad steel, however, this problem has been overcome and nickel's freedom from contamination and corrosion can now be provided at an economical price. Nickel-clad steel consists of a layer of nickel permanently bonded to a heavier layer of steel. Further information is available from the producers, **The Steel Company of Wales Limited, Shell Mex House, London, W.C.2 (Telephone TEMple Bar 2248),** or from . . .

THE MOND NICKEL COMPANY LIMITED

SUNDERLAND HOUSE · CURZON STREET · LONDON · W.1.

12/MA/2



Beetle Plasticised moulding powder used for moulding these attractive "new-look" optical instruments has done more than just give them colourful housings. By imparting to the mouldings greatly lessened shrinkage factor, Beetle Plasticised has been of material assistance to the manufacturers, A. Kershaw and Sons, Leeds, in re-entering the American post-war market.

Export brings its own problems where plastic articles moulded over heavy inserts are concerned. Exposure to intense dry heat and severe temperature variation may cause cracking and crazing. Beetle Plasticised moulding powder incorporates a special plasticiser to lessen the shrinkage factor and overcome this tendency. Mouldings can be made from it in all the many standard Beetle colours with a particularly warm texture and fine finish. If, like Kershaw's, you are exporting to a hot, dry country, or moulding over heavy inserts, perhaps Beetle Plasticised can help you too.

Whatever your moulding problem the B.I.P. Technical Service is always on call to help you in choosing the right material to ensure the best results.

Beetle Moulding Powders conform to the standards laid down in BS 1322.

BEETLE Plasticised B·I·P GROUP

AMINOPLASTIC MOULDING POWDERS

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BEETLE is a trade mark registered in Great Britain and in most countries of the world.

D

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By severely cutting down the need for visits to the "Doctor", Sagar Carbide tipped saws (and knives and cutters) run longer without interruption of output and so provide considerably healthier production rates. The grade of carbide tip maintains high planed finishes with little waste throughout long runs on plywood, "improved" wood, teak, fireproofed timber, plastics and other hard and abrasive materials.

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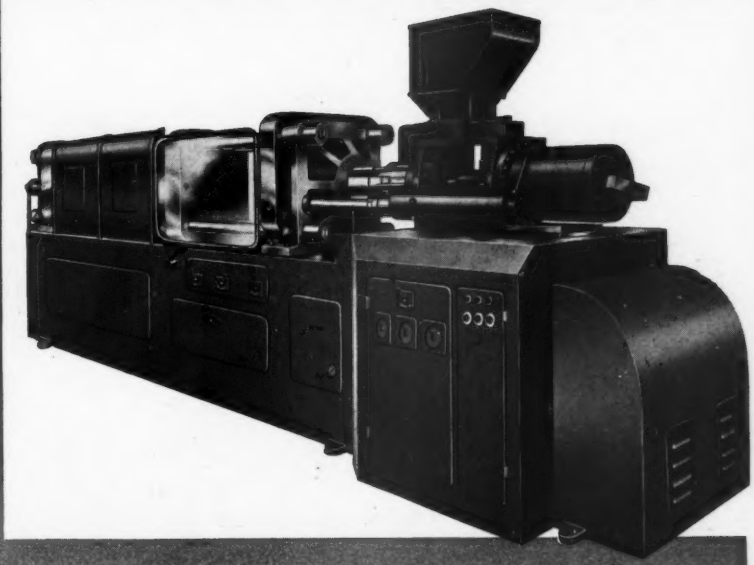
CANAL · WORKS HALIFAX

ALSO AT LONDON AND BIRMINGHAM

Hopwood

The S.H. 16/20

INJECTION MOULDING MACHINE WITH AUTOMATIC TIME CYCLE CONTROL



another achievement

The Pioneers of Plastic Injection Moulding Machines have again achieved another success with the New S.H. 16/20. This heavy duty machine is capable of producing articles up to 20 ounce weight in a variety of materials, and incorporates several new features.

Other sizes also in production are S.H. 12/16, 16 ounce, and S.H. 24/28, 28 ounce.

May we send you full details of this machine or arrange for a demonstration?

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Polystyrene Moulding Granules

manufactured by

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The **RIGHT** Plastic
for injection, compression and extrusion
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NEW IMPROVED CRYSTAL

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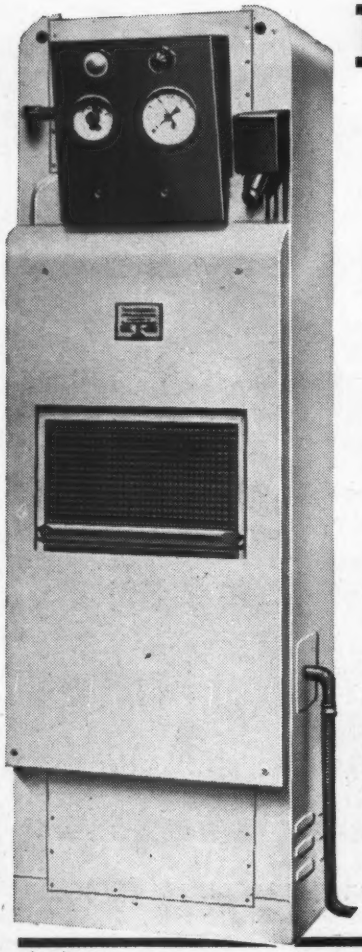

The illustration shows our new 50-TON *COBORN* HYDRAULIC PRESS for plastic or rubber mouldings, platen size 17" x 16". Illustrated leaflet on application.

We also Stock Reconditioned Machinery of all types for both the Plastics and Rubber Industries.

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P/493/P121

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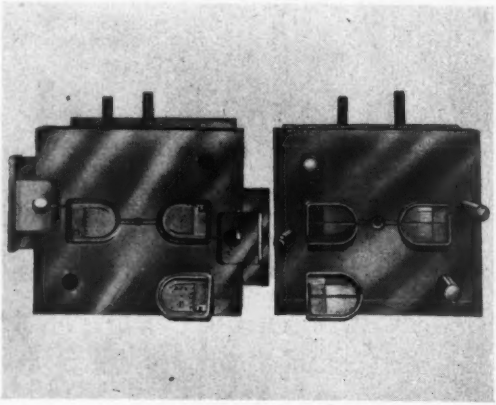

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offer a wide range of General Power Units including Motors, Generators, Transformers, Engines, and in particular any "Specials" for the individual requirements of the Plastic Industry . . .

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GPU GROUP

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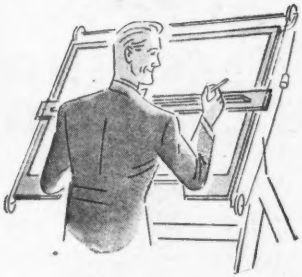

for sound ideas and plenty of know-how

If you have a moulding problem—in plastics or ebonite — Lorival will gladly design a job to suit. If your design staff takes a poor view of that, Lorival will perhaps be able to offer suggestions to make moulding easier and will tool up the job for quick and economical production of your mouldings accurately and on time. Lorival will gladly collaborate with you at any or all stages of design.

L.12

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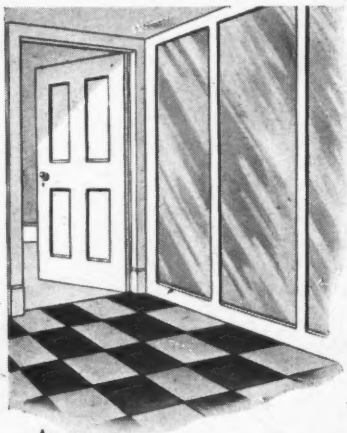

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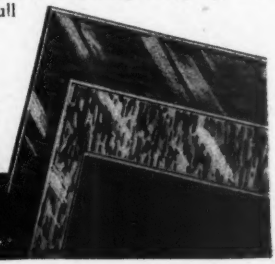

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H

If you have an inspired moulding idea that seems impossible, don't dismiss it right away. Get in touch with us and we'll "have a cut at it" by injection moulding. The more difficult it is the more we like it! . . .

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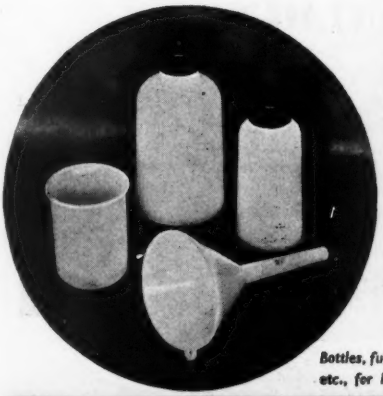

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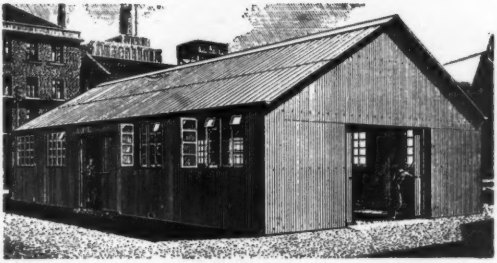

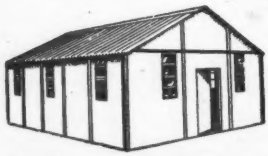

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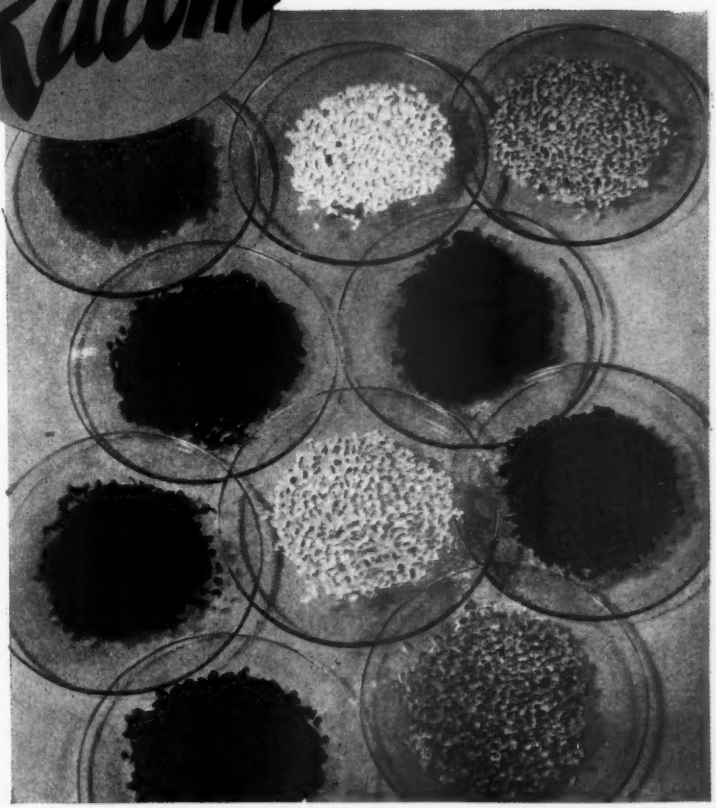

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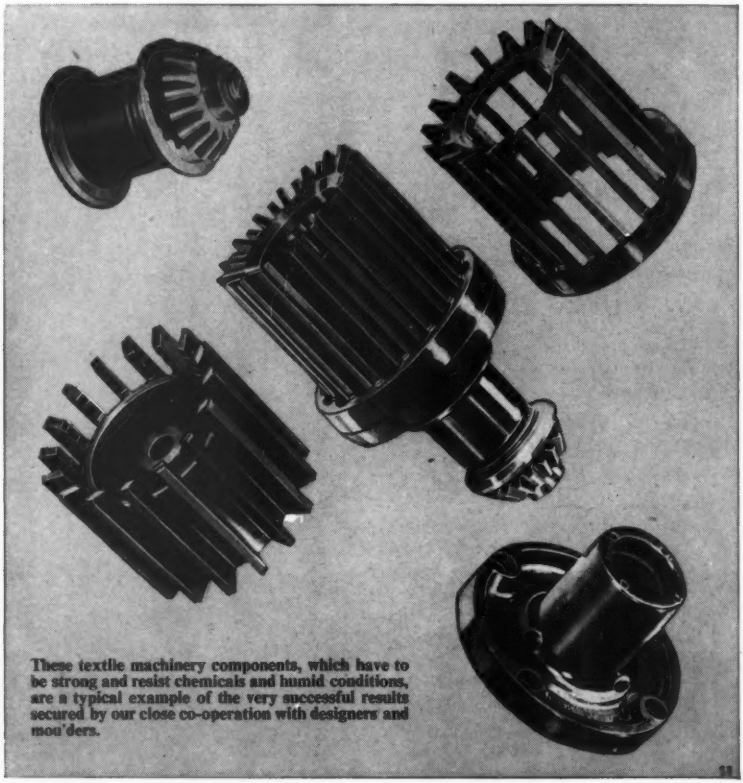

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Vol. XIII. No. 146. JULY, 1949

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

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NOTICES

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"To Soften Horn: To one pound of wood-ashes, add two pounds of quicklime; put them in a quart of water. Let the whole boil till reduced to one-third. Then dip a feather in, and if on drawing it out, the plume should come off, it is proof that it has boiled enough; if not, let it boil a little longer. When it is settled, filter it off, and in the liquor thus strained, put shavings of horn. Let them soak for three days; and first anointing your hands with oil, work the horn into a mass, and press or mould it into any shape you please."

"The Young Man's Book of Amusement, containing the most interesting and instructive experiments in various branches of science," Halifax, 1840.

EDITORIALS

Crescendo Plastico

IT is only a few months ago that we reported the rapid evolution of the large injection press and the simultaneous production of larger and larger injection mouldings. It seems only a few years ago that the process of injection moulding was synonymous with small mouldings, yet to-day the 24-oz. and the 40-oz. charges are practised in this country, while in the U.S.A. one concern, at any rate, employs the biggest machine so far produced, with an 80-oz. charge. It is obvious, of course, that the proper function of such large types is to produce large mouldings and not merely a larger number of small mouldings. It is confidently hoped that with accumulated experience we shall enter fields hitherto untapped.

The same argument is applicable to pressure moulding which, indeed, began the practice a good many years ago, long before injection moulding grew "long trousers." Nevertheless, recent developments in the U.S.A. are startling enough, as a recent article in "Modern Plastics" described. Larger mouldings of any type in a sense merely reflect the growing stature of the plastics industry, just as bigger plant is necessary in any growing industry. It is, we take it, not only the result of a desire to get new business in new fields; it is also the direct and inevitable result of greater experience in larger machines and large moulds, and a closer understanding and control of the finished mouldings themselves. Equally important, it is the result of the courage of organizations and their ability to build up considerable reserves to embark on big capital expenditure of this type. It is quite certain that in this life one cannot move from the laboratory scale, so to speak, to large-scale production in one jump. The intermediate experience has to be dearly bought.

Among the "outsize" mouldings now being produced in the U.S.A. are many of a novel character. One type of television set is moulded in two pieces, each of 11 lb. A washing-machine gyrator—presumably what we term agitator—is made weighing 2¼ lb., the mould being a six-cavity one. A moulded fishing-tackle box is 22 ins. long, 7 ins. wide, 7½ ins. high, and weighs 11 lb. It is confidently stated that 40-lb. mouldings will soon be produced in the U.S.A. We admit that what interests us especially is not so much the weight as the new type of unit, for no doubt similar lines will be followed here.

However, we in this country are not necessarily lagging behind in large mouldings. Presses of 750, 1,000 and even 3,000 tons were not unknown in pre-war days when radio cabinets and motor faciaboards were commonly known facts of production. For example, the faciaboard of the Sunbeam-Talbot of 1938, moulded by Thomas de la Rue, Ltd., weighed 3½ lb. and was 39 ins. long.

All known existing mouldings, however, seem very small beer when compared with that which was produced in England—in Lancashire, if we remember aright—before and during the early years of the war. It was a coffin, moulded of Bakelite phenolic moulding material, which weighed 80 lb. without the lid. Presumably, too, it was the largest, in addition to being the heaviest, ever made. We remember this well, for then we had been loudly denouncing the suggestion that plastics are with us from the cradle to the grave. Confronted with a baby's rattle and the excellent coffin (or should we say the mortician's delight?), our argument, although it referred to daily paper propaganda, fell rather flat.

While this very successful production ceased during the war, owing to shortage of raw material, it was a good example of courage on the part of the company involved and of good moulding.

It has never since been surpassed in size. But another, heavier and larger we believe than any other in production, is that made by Aeroplastics, Ltd., of Glasgow, for G. and J. Weir and Co., Ltd., the famous engineers, also of that Scottish town. It is an exceptional heavy-duty job, a base-plate (weighing 31 lb.) for a compressor. We report some of its details on page 357.

The King's Birthday Honour

THE plastics industry has hailed with delight the singular honour of Knighthood that His Majesty has bestowed on Laurence Pierce Brooke Merriam, M.C., for his work during the late war, first as Controller of Plastics, and later of Examiner of Controls to the Board of Trade.

With his life-long knowledge of experience of the plastics industry—his company and his family began celluloid manufacture in this country well before the end of the 19th century—he was eminently fitted for his posts. In those difficult days during the creation of his organization, of changing definitions of priorities, of shortages and of improvizations, he held the balance with scrupulous fairness, helpfulness, tact and diplomatic urbanity. His explanations of new difficulties or of new methods of control that arose at various times during the war, and made during his frequent meetings with the representatives of the Plastics Industry, were models of complete understanding of the worries of his hearers and of the art of obtaining cheerful co-operation. The editors of the industry's two technical journals will always be grateful for the meetings he held to keep them posted with important happenings.

Sir Laurence Merriam.

In offering Sir Laurence our sincere congratulations, we are sure we also express the wishes of all our readers.

"Plastics" Increases its Format

When severe restrictions in the supply of paper were applied in 1942 we were compelled, like so many other journals, to reduce the size of "Plastics" to its present "pocket-size" form. Now that restrictions have been lifted, it is with pleasure that we announce that, beginning with August issue, we shall revert to the original size. This change will enhance greatly the appearance of the journal and allow us to introduce other improvements, a step which we are sure our readers will approve.

MOULDING POWDER AND SHOT

Chemical Research Laboratory

On Tuesday, June 28, the Chemical Research Laboratory was open to the public and I spent an enjoyable afternoon there at Teddington, finding out what was being done. In the High Polymer and Plastic Section, of which Dr. K. W. Pepper is the head, I was interested to note the strong emphasis laid on research on one special branch—that of ion-exchange resins, which were first discovered in this laboratory nearly 20 years ago. Dr. Pepper tells me that Gt. Britain inevitably lost a lot of ground during the war in this research so important to industry. The earlier resins have been superseded and the new research concerns that of monofunctional ion exchange resins such as suphonated crosslinked polystyrene, and polymethylacrylic acid. For the first time a very strong team of young workers is on this problem. I was also glad to see new research on metal glues (e.g. resorcinol formaldehyde resin) and the stress laid on the prerequisite of proper treatment of the metal surface. Controlled mild abrasive treatment gives more reproducible results than acid pickle. Valuable work is also being done on the silicones.

* * *

Plastic Tape for Recorders

The report on the Hanover Fair on page 358 of this issue contains a note regarding the production of polyvinyl tape for "magnetophone" tape-recorders. In view of world-wide interest in such recorders, both by broadcasting companies, by business interests, and even by the public (home recorders are available in some countries), it seems astonishing that British production of the plastic tape should lag behind. The steel wire or tape has long been known in this country, while one company whose home recorder I saw at the B.I.F., employs a paper-base type. Cellulose acetate tape is employed by one concern in the U.S.A., whilst Germany has long been interested in a type made from p.v.c., especially in the stretched form, and known under the name of "Luvitherm." All organic tapes are coated subsequently with magnetite. Production to attain complete freedom from noise interference has its own problems.

* * *

Metallized Plastics

Dr. Dubois, editor-in-chief, "Plastiques Modernes," was over here for the B.I.F. He told me that normal electroplating on plastics in France is giving way to what might be called the "vacuum" deposition of metals. The processes under this heading may be divided into two types, sputtering and vacuum evaporation, and have been known for many years, especially in the electrical world. To-day, so excellent and efficient are high vacua-pump production and technique that these processes may yet prove cheaper than electroplating; they are stated to provide better results regarding quality of surface and adhesion, and comparative simplicity. Certainly Crookes did much of the original work as far back as 1891. We made mention of the possibilities for plastics as long ago as 1937, whilst Mr. Halls elaborated on them in our March, 1944, issue.

* * *

Jubilee for B.I.P.

The years roll by. Twenty-five years ago I knew British Cyanides, Ltd. well, and remember the first rumours of the remarkable new urea resins that were then about to appear. On July 15 British Industrial Plastics, Ltd. (the change in name was made in 1936) celebrates the jubilee of 50 years in the chemical and plastics industries, at the Dorchester Hotel. At the same time Mr. Kenneth Chance retires from the managing-directorship, so this gives me an excellent opportunity of wishing him and the company the happiest of futures.

DOGSBODDY.

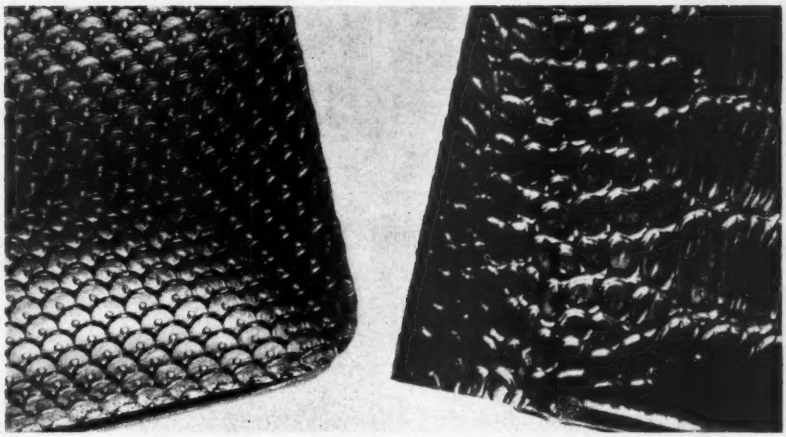


Fig. 1.—Surface embossing for p.v.c. wallets. Left: a design rather like overlapping fish scales. Right: imitation crocodile.

There's Nothing Like Leather

By M. D. CURWEN, Editor

WHENEVER I want to know something about leather I drop in to see Mr. John Waterer, managing director of S. Clarke and Co., Ltd., whose works are next-door to these offices, and who make, among other things, those lovely suitcases, travel bags and hat boxes of the finest leather and raw hide that warm the cockles of your heart, make your eyes glint with envy, and that sell in the best shops at anything up to £40 a time. And they are worth every bit of the money with the exception of the purchase tax, which, owing to the wisdom of the Board of Trade, is a mere 100 per cent. An additional 10 per cent. comes in somewhere, and is known by the stupid name of "uplift," but which name is by no means as stupid as the tax itself.

However, what I want to say is: whenever I want to know about leather I ask Mr. Waterer. He is not only a craftsman in leather but also a designer of his goods of the first order, and, most important, is willing to impart his knowledge to others. To watch him lovingly passing his hand over a good job of leather work is a joy. Thus it is that I know something of leather, its choice, the inner construction of the goods, even the deep mystery of making those corners of suitcases without folds, and the treatment of hide to mitigate attack by rot fungus and bacteria. In fact, I can now pretend I'm an expert to somebody who knows nothing at all about the subject, although, of course, I have to do a bit of preliminary detective work before I can launch forth on my superior attainments.

Mr. Waterer, being also a wise person and a business man, has long been interested in plastics, and his work in this direction in patiently examining all types that come his way, conscientiously and without bias, deserves the special thanks of the plastics industry.

The other day he phoned to me saying he had something to show me. Indeed, he had several things, two of them of special importance. One was a prototype

Fig. 2.—Travel trunk with exterior covering of "Tygan" supplied by Fothergill and Harvey, Ltd. (Courtesy, S. Clarke and Co., Ltd.)

travel trunk with an exterior of "Tygan," the fabric made by Fothergill and Harvey, Ltd., which is woven from "Bexan," the filament made by BX Plastics, Ltd. We already noted this material, which is as hard wearing as horsehair, about a year ago. The accompanying photograph shows the attractive design of the surface, which was woven of red and blue filaments. "With this," said Mr. Waterer, "the plastic industry is giving us something new." And then he showed me yet another prototype, a "soft" suitcase, of p.v.c. sheet made by Vinyl Products, Ltd.

"Here again," he said, "the plastics industry is giving us something interesting and approaching what we want." It was what might be called an "eggshell" finish; that is, a non-glossy surface and yet not dull—a slightly grained texture, coloured a delicate mid-brown, with a lighter brown underlayer. The effect is very pleasing and is very resistant to abrasion.

"Generally speaking, however," added Mr. Waterer, "cannot the makers get free from the inferiority complex which

Fig. 3.—Soft suitcase of p.v.c. sheet supplied by Vinyl Products, Ltd. (Courtesy, S. Clarke and Co., Ltd.)

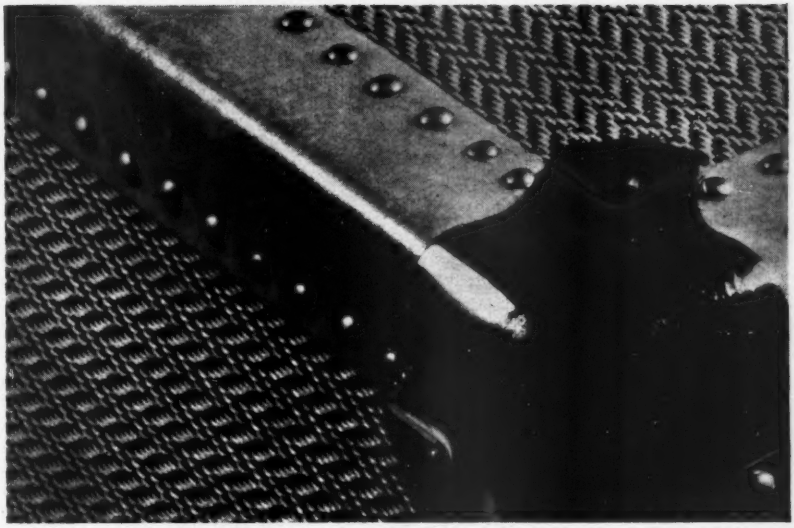


Fig. 4.—Full-size photograph of one corner of the travel trunk seen on the opposite page, showing surface texture of the woven "Tygan" fabric. (Courtesy, S. Clarke and Co., Ltd.)

dictates imitation? What I mean is, that if plastics are to succeed they must do so on their own merits, and this applies not only to the quality of the material itself—its strength, wearing and working properties—but also its 'feel' and appearance. The luggage industry does not want imitation of leather, and with all the traditions based on thousands of years of work on a material which is and was, in fact, a growing structure with designs produced by living cells, resents imitations which can, in fact, be only superficial. The plastics industry produces new remarkable materials, and should devise designs most suitable to a material that has no fibrous structure. Never forget that the public know and love leather, and can quite adequately distinguish between the feels of leather and plastics."

Now it was my turn, and with the smartness of a prestidigitateur produced my chef d'œuvre—a wallet I have had for rather more than two years and that is in almost exactly the same condition as when it was given to me. It is of H.F.-welded p.v.c., with a design rather like overlapping fish scales or the elements of Norman armour (Fig. 1, left). Mr. Waterer admired it. He said, "Yes, that is really new and typical of what I mean."

And then I told him the sad story. Between two or three years ago the manufacturer gave it to me and asked my opinion. I was extravagant in my praise, for the design was so much what I wanted to see—a design peculiarly plastic and only possible in plastic—I foresaw the manufacturer a millionaire in no time, and enthusiastically accepted a sample wallet and published a photograph of it in these pages. I am not sure, but I think Erinoid, Ltd., embossed the design.

Some six months later the manufacturer came again to see me, and expectantly I asked him how the wallets had sold. "I haven't sold one of that design," he said, and added, with a twinkle in his eye, "but I've sold thousands upon thousands of these." And he pulled out a variety of "crocodile," "morocco" and

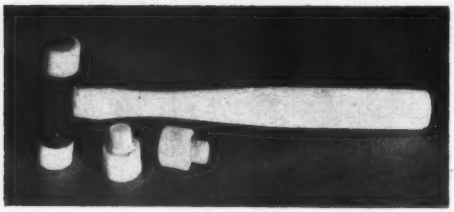


Fig. 5.—This "Thorex" plastic hammer, with renewable polythene faces, is being used in place of the conventional raw-hide hammer for beating metal. (Courtesy, Thor Hammer Co.)

other leather imitations (Fig. 1, right). "The public," he said, "do not want anything but leather or an imitation of it."

My heart sank. Of what use were the fine phrases I had written and uttered to the effect that plastics must produce its own designs?

I think what had happened occurred during the Christmas period, when wallet buying is buying to give Christmas presents, and since genuine crocodile and morocco are so expensive, the giver subconsciously or consciously wishes to impress the receiver. Truly a harmless deception and an understandable one.

There is something very queer about this imitation business. I am all out for designs in plastics which are only possible in plastics because of their very nature. Heaven alone knows, I have written and talked about the subject long enough, and have listened with respect to artist-designers in traditional materials who ought to know. Yet, on occasion, I become a traitor, a veritable Vicar of Bray, and think to myself, the words "imitation" and "substitute," according to the dictionary, simply mean "similar to" or "used instead of" and not necessarily something inferior. Surely there are bad, good or better substitutes, and we can have bad, good or better imitations?

I saw an example of a substitute for leather that was better than the best raw-hide on the stand of the Thor Hammer Co. at the Birmingham B.I.F. It was a hammer for beating metal, with a moulded and threaded polythene head, replacing the traditional raw-hide head that had been used for hundreds of years. According to the salesman, who has sold raw-hide hammers for years, the polythene head can be used worn down to about ¼ in. and replaced, while the raw-hide hammer had to be discarded entirely with much less of the leather used.

But to return to leather bags and p.v.c. sheet. The whole of a hide is very unequal in properties, and the perfect piece is rare. Not only is the centre different in quality from the sides, but spoilage by anything from warble-fly to barbed-wire or bacteria is very common, and hide also has to go through a comparatively slow and expensive process of liming to remove hair, and curing, before it can become leather. And after that, even the best leather in tropical climates can, if not treated to resist it, be covered with a green scumming fungoid growth overnight, as I myself discovered very many years ago; in fact, "lovely grub" for fungus.

With p.v.c., on the other hand, in a given sheet of any width or length, the material is of the same constitution throughout. It is, or should be and can be, equally high quality everywhere, with no quality rejects. Now, in the suitable thickness it is very tough, and in certain goods wears as well as leather, although we must be fair and qualify this, as so much is made with leather that is not of the finest quality. There are thus many difficulties in the way of finding a true comparison. We are also improving plastic materials at a far greater rate than leather is improving, and one day we shall produce a sheet of p.v.c. or similar plastic that is far better than the best leather. That, in my opinion, is very certain.

There remains the question of imitating the surface design. High ideals and artistic research may result in convincing

the public that unusual and novel designs in covering materials are as good as conventional designs of lizard, crocodile, morocco and so on, and they may one day be acceptable. But in the meantime, by a strange aberration of the mind, the plastic sheet makers do not want to starve. Hence the p.v.c. sheet in crocodile, morocco and lizard designs. I am not the only one who thinks they are good—very good. Witness the fact that at the B.I.F. I saw two stands in which all the handbags were of p.v.c., and on many other stands both leather and p.v.c. bags were shown. Also witness the fact that many women think them marvellous because of their wearing properties and because of their design—in crocodile and all the others!

Incidentally, Mr. Waterer states that before some plastic materials can become practical and economical for luggage, adhesive means will have to be devised which will permit of a perfect juncture with plywood, fibre-board and other stiffening materials. Among the latter, "Fibrenyle," as a support to leather outside, saves weight, gives strength, and makes possible new interesting shapes which are not economically practicable in either fibre-board or plywood.

By the way, Mr. Waterer thinks that p.v.c. is too expensive, even at the present unwarranted price of leather with its 110 per cent. purchase tax, as against 66⅔ per cent. for p.v.c. When things become "normal" again, the resistance against p.v.c. will be greatly increased.

This Nicholas Bentley design has been incorporated in "Warerite" material to provide a surround to the first-class cocktail bar in the Cunard-White Star Liner, "Caronia." The architect responsible for the interior design was Mr. Patrick McBride, of McInnes, Gardner and Partners. L

Casting Resin and Plaster by Aid of Hot-melt Moulds

By J. STEWART

ONE of the important developments in plaster and cast resin manipulation, and to a lesser extent in cement fabrication, has been the development of certain vinyl compounds for use as hot-melt mould-forming materials* to replace gelatine and rubber moulds.

It has been obvious for a long time that a substitute for gelatine was long overdue. The chief complaint with jelly moulds is that they age, and in ageing lose their shape. The new hot-melt mould-forming compounds do not age, although they will, when subjected to pressure, show a distinct creep.

Jelly moulds have a fluctuating water content, and being water-soluble they have a definite production life. The vinyl compounds, on the other hand, are water-repelling and therefore the life of a vinyl mould is more a matter of handling care, rather than composition. Given a simple jelly mould and the same mould made of the new hot-melt compound, in production the latter will give many times more articles per mould than the jelly. Provided that mechanical damage in handling does not occur, the mould life of the hot-melt compound may be said to be unlimited.

In manipulation, i.e., the preparation of the mould material, the honours are about even. There is little difference in heating small quantities of the new material; large quantities, because of poor heat conduction, are more difficult to prepare, but against this there is the fact that, given appropriate melting equipment, the mix will always be more consistent than jelly, as there is no adulteration or modification of composition. The hot-melt compound is not diluted in any way, and where accuracy of reproduction is important the dimensional accuracy of the mould can be assured.

Although it is possible to vary the composition of gelatine for specific requirements, it is usually a "rule-of-thumb" procedure and a reflection of the skill of the operator, who has spent years acquiring the "feel" of his medium. A point in favour of the hot-melt compounds is that a whole range of compositions is available for diverse applications. For example, for cement work or large plaster shapes, the weight of the gauged material may be sufficient to push the mould out of shape. As there is a limit to the support that can be given to some moulds, obviously a stiff, "jelly-like" material with high tensile strength is called for.

For fragile shapes, such as a long-eared rabbit cast in plaster for decorative purposes, the importance of extracting the article from a one-piece mould suggests that the mould-forming compound should be as elastic as possible.

Rubber moulds also compete with gelatine and these new hot-melt compounds, but rubber moulds start with the handicap that they cannot be remelted and re-used. Further, as they have a very high contraction factor their use is limited. Moreover, in the field of cast resins there is really no comparison, as jelly gelatine moulds cannot be used for cast resin, as the latter reacts with the gelatine.

As with most new developments, hot-melt mould-forming compounds have had to pass their teething troubles. The plaster-casting objection to vinyl mould

* The nomenclature of these materials is not simple. Sometimes they are elastomers, since they are derivatives of rubber-like compounds, e.g., polyvinyl resins. On the other hand it is highly probable that other types of different origin, yet still retaining some elastic properties, will appear. Hence for the time being, we may retain the rather clumsy name "hot-melt mould-making compounds."

compounds is mainly that the operator cannot always make a good mould from a plaster prototype. When examined, however, this objection is not as final as it appears. Obviously when a hot-melt material is poured on to a dry plaster article the air in the plaster is heated, and in heating it expands and must escape. All too frequently it escapes via the mould, resulting in porosity.

Experiments have been made to overcome this trouble, but a universal cure has yet to be found. Methods which have given very fair results include that of using the plaster in a damp condition, i.e., a short time after the gauged material has set; impregnating the plaster prototype with phenolic sealing lacquer; soaking it in wax; immersion in oil; using thin, hollow shapes so that the air is driven through the plaster to escape via a vent; and incorporation of cast resin in the plaster to give a non-porous compound. The trouble can also be overcome by using vacuum, but for workshop purposes this is impractical. Metal, glass and porcelain articles as prototypes or master patterns give perfect moulds when the right technique is employed.

One reasonable procedure is to electroplate the plaster master pattern with copper, nickel or chromium; provided the plate is efficiently deposited, very good moulds can be made in this way. Dipping the article can, where convenient, provide another solution to this vexing problem. Again, damp plaster should be employed, and the mould is built up on the onion-skin principle. Methods vary with the size and shape of the article from which a mould is required.

Another point of less importance which must be tackled relates to the objectionable smell of the vinyl compounds when they are being melted. These hot-melt compounds must also be made more resilient for many applications. This is not merely a question of ease of ejection from the mould; it concerns their use by a careless operator. When the thumb nail is pressed into the vinyl compound it can leave an impression. For most plaster applications this may be of little consequence, but for fine work and accurate cast resin reproduction it can seriously influence production.

One novel hint for overcoming this "brinelling effect" is to combine a thin skin of p.v.c. with a bulk of the hot melt. The article or master pattern is painted with a reliable p.v.c. paste and heated to a point when the p.v.c. starts to just flow; the hot melt is then poured on top. Good adhesion is obtained in this way and the finished mould has a tough lining of p.v.c., yet the main advantage of the bulk of hot-melt compound is retained. For small cast resin work this dodge can prove very useful, as it not only prevents laceration of mould surface, but as the p.v.c. is not nearly so heat-sensitive it also protects the bulk of the mould.

In the field of cast resins, hot-melt vinyl compounds have already had a considerable success. Prior to the introduction of the vinyl compounds, the available mould materials were p.v.c. and chemically resistant rubbers. When properly used, p.v.c. makes an excellent mould material for the phenol-formaldehyde type of cast resin; the p.v.c. is very strong, non-reactive, takes a high lustre, and is firm enough to be used without a supporting case. The obvious disadvantage, when compared with the new hot-melt vinyl compound, is that p.v.c. cannot be remelted; mould cost has, therefore, to be written off and spread over the number of articles used.

Rubber, in the opinion of the author, is a more serious competitor, but, again, it cannot be reclaimed, and therefore unless skin moulds supported in plaster cases are used, the waste-mould factor can also be an expensive item.

The problem of gasification when the new hot-melt compound is used with plaster or cast resin prototypes still exists, but the best answer is to electroplate the article as already suggested. For copy and reproduction work from glass, metal, ivory or porcelain, the hot-melt compounds are excellent.

World's Industry Employs Plastics

GENERAL ENGINEERING

Flexure testing.—I. W. Westwater has investigated experimentally seven factors concerning flexural tests. He used rectangular beams, simply supported and loaded at the mid-span. (Abstract, A.S.T.M. Bulletin, 1949/May/16.)

Stiffness test.—D. S. Stechert develops the theory of cantilever bending under large deflection, based on a parabolic stress-strain function, in stiffness testing for rubber. Theory and experimental determinations on four rubber compounds show that hitherto devised tests do not lead to a fundamental measure of elasticity. (A.S.T.M. Bulletin, 1949/Mar./61.)

Impact testing.—B. Maxwell and L. F. Rahm have investigated this problem and have devised a new method and apparatus of measuring impact strength of polymeric materials. Comparison of results show that the new method ranks materials in order of their service performance. Impact strength as determined by the new method is independent of mass of broken sample; thus testing with various velocities can be performed. (Abstract, A.S.T.M. Bulletin, 1949/May/16.)

Creep tests.—W. J. Worley and W. N. Findley report on creep tests on polystyrene and on a melamine/glass laminate, at temperatures of 40, 77 and 130 degrees F., for a time interval of about 2,000 hrs. Correlation of data with activation energy theory has been attempted. (Abstract, A.S.T.M. Bulletin, 1949/May/16.)

Testing adhesive joints.—W. N. Findley and B. A. Century will report at the 52nd annual meeting of the A.S.T.M. on fatigue tests of aluminium-alloy joints bonded with cycleweld adhesive. Single-lap, double-lap and butt joints were tested in an axial-load fatigue machine. The lap joints subjected the adhesive to shear stress and the butt joint subjected the adhesive to tensile stresses. (Abstract, A.S.T.M. Bulletin, 1949/May/13.)

Tap for plastics.—A multifluted tap for threading holes in plastics has been developed by Hy-Pro Tool Co., New Bedford, Mass. It is said to consistently produce smooth threads of uniform size even in hard plastics and those containing cloth and glass fillers. ("Machinery" (N.Y.), 1949/Feb./207.)

CHEMICAL

Synthetic formaldehyde.—In a new process, methanol is vaporized in a steam-heated vaporizer, mixed with sulphur-free air and fed to a converter, where oxidation and dehydrogenation occur simultaneously. ("Chem. Engineering," 1949/Feb./120.)

Resin from Coal.—Refined resins are being produced from bituminous coal by Combined Metals Reduction Co. The resin is separated by flotation. The 60 per cent. concentrate is mixed with hoxane in a multistep operation. ("Engineering and Mining J.," 1949/Jan./81.)

New hydrocarbon resin.—Isopal, comprising about 75 per cent. styrene and 25 per cent. isoprene, is of moderate molecular weight. It is in pilot plant production by Union Bay State Chemical

Co., 50, Harvard Street, Cambridge, Mass. The material is clear, hard, nearly water-white, and possesses many of the chemical properties of rubber. It is unique in being completely soluble in petroleum naphate. ("Products Finishing," 1949/Jan./112.)

Sulphonamide resins.—W. Scheele and co-workers offer a proof for a new conception of the constitution of the sulphonamide resins, being a product of arylsulphonamides and formaldehyde. It is stated that sulphonamide resins do not contain macro-molecules of polymerized N-methylene arylsulphonamides, but are undercooled melts of mixtures of the trimere N-methylene arylsulphonamides with unchanged sulphonamide. ("Kunststoffe," 1949/May/109.)

Vinyl co-polymers.—A flowsheet of the various steps in the production of polyvinyl chloride-acetate co-polymers has been worked out by J. Zeelander, with the help of manufacturers. ("Mechanical World," 1949/May 27/621.)

Formation of phenol resins.—Experimental work on the hardening of phenol alcohols have been extended by K. Hultzsch by further studies, and a satisfactory picture has been obtained. A short survey is given on recently discovered hardening reactions. ("Kunststoffe," 1949/Mar./57.)

MISCELLANEOUS

Helicopter blades.—Sikorsky R-5 helicopter will use combination of stainless steel and plastic rotor blades during flight tests. Behind main-spar installation is a 0.007-in. core of laminated phenolic plastic between 0.0015 in. stainless steel. ("Business Week," 1949/Feb. 21/21.)

Replica technique has been recently perfected for studying conveniently the texture of porcelain enamel. One gram of ethyl cellulose is dissolved in 100 millilitres of a solvent composed of 80 parts of toluene to 20 parts acetone by volume; the solution is spread and pressed on to the surface under a square sheet of ethyl cellulose. After drying for a few minutes the replica can be easily stripped off. ("Technical News Bulletin," 1949/May/55.)

Spray treatment for polystyrene (Bea Chemical Co., 13799 S. Avenue O, Chicago, Ill., U.S.A.) is now easily applied with conventional equipment; surface hardness and brilliance are not sacrificed, sensitivity to humidity has been greatly reduced. ("Materials and Methods," 1949/May/98.)

Boats of tubular plastics consist of individually sealed tubes of "Vinylite"; if one tube is punctured the boat will still keep afloat. A 56-in. boat holds two children; a 72-in. boat, with an inflated bottom, carries two adults and two children. The producers are Bilnor Corporation, 71 Baruch Place, New York 2, N.Y. Wading pools, baseball bladders and floats are produced in a similar way. ("Science Illustrated," 1949/June/70.)

Cellulose ester fibres.—A committee of the A.S.T.M. has now accepted the name "estron" as a generic term of cellulose ester fibres of properties different from regenerated cellulose fibres. The definition covers man-made fibres, monofilaments and continuous filament yarns composed of one or more esters of cellulose with or without lesser amounts of non-fibre forming materials. (A.S.T.M. Bulletin, 1949/Jan./9.)

Plastic foils.—A short report on the third meeting of the German committee is given. It is intended to standardize a total of 20 properties, classified as physical, mechanical, electrical and chemical. ("Kunststoffe," 1949/Mar./76.)

Lignin.—A record of work on lignin as plastics raw material by I. Sorgato, at Padua University, during the past ten years, has been published. Two factories in Venice utilize the elaborated methods. ("Chemical Age," 1949/June 11/858.)

The Fireman's New Plastic Helmet

IN our issue for April, 1949 (page 173) we referred to a new type of helmet for firemen which has been under test as the result of developments by the D.S.I.R. and the Fire Officers' Committee Joint Fire Research Organization.

Recent publication of the "Report of the Fire Research Board for 1947" (H.M. Stationery Office, 1s. 3d.) reveals that the development of an improved helmet as one of the Board's studies of fire-fighting equipment, was begun towards the end of the war, and, with the co-operation of manufacturers, was completed during 1947.

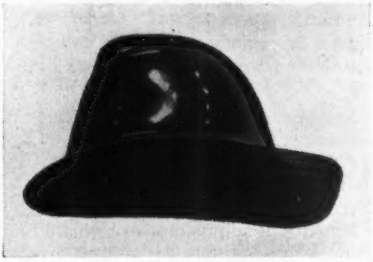
Before the war there was a variety in design, materials, and standards of performance for firemen's helmets, and the Fire Service Department of the Home Office suggested that a suitable design be found which would be capable of adoption on a National scale if required. A committee was formed to consider the desirable features of a suitable helmet, and certain requirements were drawn up as follows:—

WEIGHT: The complete helmet, with lining and straps, should weigh not more than about 2 lb.

RESISTANCE TO IMPACT: The helmet, when placed on a special support, should withstand, without material damage to either shell or lining, four blows from a 14-lb. weight allowed to fall freely through a distance of 12 ft. on to the crown, and one blow from the same weight dropped through 12 ft on to the side of the shell. In addition the shell should not come into contact with the "head" during these tests.

RESISTANCE TO SHEAR: The helmet should withstand without material damage, a blow from the edge of a 10-lb. steel plate, ¼ in. thick, falling freely through a height of 12 ft. on to the crown.

RESISTANCE TO PENETRATION: The helmet should withstand a blow from a pointed 2-lb. weight (made to a specified design) allowed to fall freely from a height of 12 ft. on to the side of the shell.



The new helmet, as exhibited at the 1949 B.I.F., by Moulded Products Ltd., Tyburn, Birmingham.

RESISTANCE TO FLAME: The helmet should show no material damage through contact with a Bunsen burner flame passed round it in 30 seconds.

ELECTRICAL RESISTANCE: The breakdown voltage of the helmet when placed on a metal "head" should be not less than 10,000 volts at any point in either the wet or the dry condition.

MOISTURE ABSORPTION: The absorption of water by the shell, when completely immersed, should be as small as possible.

The final design was essentially an imperforate reinforced plastic shell with an easily removable lining able to absorb a considerable part of the test load.

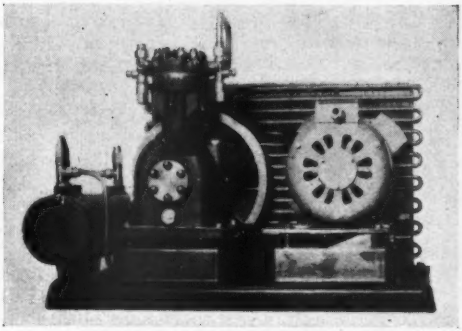
One of the new helmets was shown publicly at the Birmingham section of the B.I.F. This helmet was made in phenol-formaldehyde resin-impregnated fabric. It was moulded by a unique method of high-pressure moulding technique and delivered to meet the very stringent specification laid down by the Home Office Fire Authority.

P.V.C. SHEET PRICES.—The P.V.C. Sheeting (Maximum Prices) Order, 1948 (S.I. 1948, No. 765, I, p. 1517), has been revoked as from June 11, 1949.

Biggest Compression Moulding?

OF exceptional interest, both from point of view of size of moulding (see our Editorial, page 244) and of the particular application in a new field, we have pleasure in giving the following data regarding the baseplate here illustrated.

Moulded as a single unit by Aeroplastics, Ltd., of Earl Haig Road, Hillington, Glasgow, S.W.2, for G. and J. Weir, Ltd., of Holm Foundry, Cathcart, Glasgow, S.4, it weighs 31 lb., thus probably being the largest ever attempted in this country or elsewhere. It is the base plate for a G. and J. Weir motor compressor for the industrial refrigeration industry.



Motor compressor for industrial refrigeration, mounted on moulded plastic baseplate.

The overall dimensions are 31 ins. by 20 ins.; thickness varies between $\frac{3}{8}$-in. and $\frac{9}{16}$-in. at certain points. Moulding was carried out in a 750-ton press. A general-purpose moulding powder was used; cure was approximately 15-20 minutes.

The photograph of the compressor itself also shows a smaller moulding—a 12-in.-square drip tray, seen immediately under the compressor and on top of the main moulding.

Left: The notably large size of the baseplate is apparent from this photograph, which shows the under side.

Right: View of upper side.

Plastics at the Hanover Trade Fair

THIS year's Hanover Trade Fair had to be held in two parts. General or consumer goods were shown April 22-28; technical or production goods, May 20-30. The present report is based mainly on the exhibits in this second part, but many exhibits and exhibitors of the general Fair* were again present at the technical Fair. All available space at both fairs was occupied, thus demonstrating the keen interest of German industry to show their goods to foreign buyers.

When the Fair was inaugurated in 1946 over 10,000 foreign buyers were expected and the German goods presented were of very low quality in general, coming very shortly after a war which in its aftermath destroyed production equipment and left few raw materials. This picture has now changed; at the present Fair, German goods of high quality and pre-war standard were again offered, with a considerable number of technical and production improvements. But the number of foreign buyers, however, was much lower. With a total of 1,140 foreign buyers and 175,000 German visitors to the general Fair this year, there was only one foreign visitor to every 165 German visitors. The technical Fair registered a daily return of about 1,000 foreign visitors; assuming that each visitor was there for three days, this gave a total of about 3,000 foreign buyers.

Among new applications of p.v.c. tubing was that of covering steel tubes, in particular bent tubes, such as are used for steel furniture and for holding bars and handles on vehicles. This covering serves three purposes: it gives protection against corrosion, electric insulation, and decoration. The covering can be applied to differently formed outside sections and in many cases also for the inside of tubular bodies. Further cross-sectional differences do not hinder its application; this is very important, as connections are usually not very corrosion-resistant. Many of the coverings applied have a metallic lustre, so that they resemble to some degree the original material. A variety of such coverings were exhibited by Kantex Werk Reinold Hagen (Hangelar über Siegburg).

A new product of Anorgana Gendorf, Upper Bavaria, was "Genoton" polyvinyl chloride band for tape recorders, in which magnetic iron-oxide powder is mixed directly with the plastic material. The new material is said to correspond to highest requirements for reception and reproduction. The smooth surface of the flexible band has a minimum of abrasive action on the organs of the machine and is not liable to wear itself. The material is of high tensile strength and is not sensitive to moisture. It is supplied in rollers up to 1,000 m. length, and is available in thicknesses of 0.05 to 0.2 mm. and widths from 6.5 to 350 mm.

The p.v.c. material itself was shown in a number of interesting applications, for instance, as coloured bands of considerable strength and thickness for homecraft purposes, as in making hats, mats and baskets by plaiting. Textiles of the same material of high strength are suitable for wall coverings and as coverings for furniture. A high artistic standard was observed in the combination of colours.

Th. Goldschmidt A.G., producers of "Tegofilm" on a phenolic resin basis, showed also laminated-wood products and the combination of wood and metal. During production no fluid is applied. From this firm also the information was forthcoming that at present phenol is available in Germany in sufficient quantities, whereas shortly after the war the development of the German plastic industry was much hindered, owing to a general scarcity of raw materials, and in particular a scarcity of phenol.

A new laminated material, "Gesalith" (G.H. Sachsenröder, Wuppertal), is recommended for noiseless gears and

* A condensed report on this Fair is given in "Kunststoffe," May, 1949, page 131.

The "Presto" H.F. plastic welder. (Scillo Elektromed. Apparate K.G.)

bearings. It is said to consist of horn-like layers, and in many respects to be superior to the laminated textile materials now in use. Teeth of extremely small pitch can be cut, for instance, as small as 0.5 mm. module (diametral pitch 50.80). The following properties are quoted in conformity with D.I.N. standards: Bending strength, 1,600 kg./sq. cm. (22,800 lb./sq. in.); impact bending strength, 54 cm. kg./sq. cm.; notch impact strength, 29 cm. kg./sq. cm.; compression strength, 3,400 kg./sq. cm. (17,800 lb./sq. in.); tensile strength, 1,250 kg./sq. cm.; hardness, 21.8 kg./sq. mm. The material is resistant against oil and fat up to 130 degrees C.

Bemberg A.G. is now making "Cuprophan" foils, which are produced in the same way as their rayon material in four qualities of 15, 23, 30 and 40 gram/sq. m., corresponding to thicknesses from 0.012 to 0.027 mm. The material is supplied in rolls and sheets, also in cut form in any size required, and for the cable and textile industry in fine-cut form. It is also used to a large extent for producing small bags for packaging purposes.

A new laminate, "Durofol," consists of natural wood veneers which are pressed with plastics to a homogeneous material resembling natural wood. Bremshey and Co., Solingen-Ohligs, uses this material for the seats of buses.

Laminated safety glass, "Sigla," with an intermediate plastic layer, is now available in spherically and cylindrically bent form which now permits the application of this glass for the modern curved body shapes of private cars and buses. The glass is tested for binding strength of the plastic layer from temperatures of 100 degrees C. to −30 degrees C.

Synthetic Buna rubber is almost exclusively used for the sealing rings of C. Freudenberg K.G. and is sold under the name of "Simmerring." The same oil-resisting materials are used for various shapes of sealing rings. The Goetzewerke also use a Buna product, "Tembran," for the sealing of rotating shafts.

Tubes of flexible plastic material, for oil, petrol, compressed air, etc., were offered by Techno-Chemic G.m.b.H., Kessler, under the trade name "Silberschlauch." As a novelty, flexible tubes are braided by plastic bands which give the tube great resistance against all types of external wear and tear.

Rost and Co. showed further developments of their plastic "Guttasyn" tubes and foils, both most probably on a p.v.c. basis. K. Hornschuch A.G. demonstrated light, medium light, and heavy artificial leathers on a woven and a layer basis, as well as p.v.c. foils.

The Internationale Galalith Gesellschaft showed various types of compression and injection moulded plastics, as also synthetic horn products. Gruenzweig and Hartmann have extended their range of heat insulating materials by a plastic sponge material, "Iporka." Moulded phenol-formaldehyde articles, mainly for the electrical industry and domestic use, were shown by Presswerk Schoeppenstaedt. Boehmer and Co.

exhibited plastic lamps for walls and ceilings.

Production Equipment

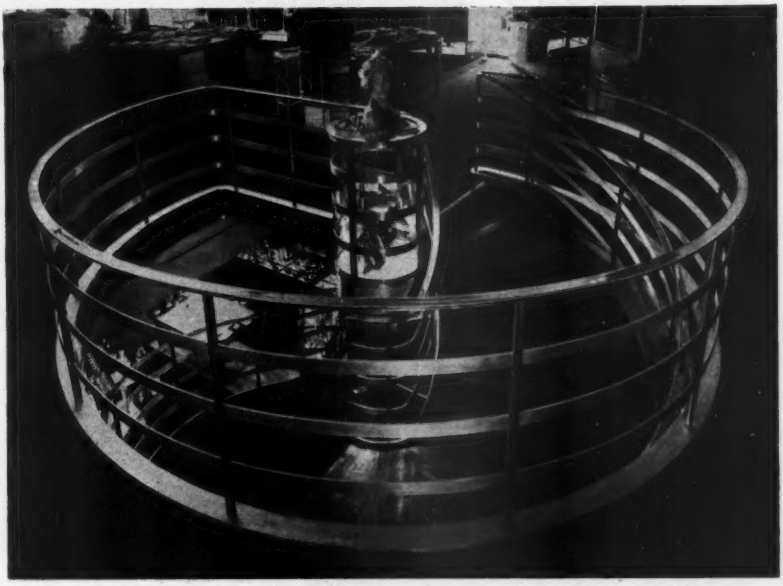
Preform presses were exhibited by W. Busch, who also are producers of press tools; other exhibitors where W. Fetter and Schaudt Maschinenbau. Dr. Fritz Sommer also specializes in press tools.

A Hamburg firm making electro-medical products (Scillo Elektromed. Apparate K.G., Spitalerstr, 12, Hamburg) has now developed the "Presto" H.F. plastic welding machine, illustrated on page 359, which uses high-frequency current for the production of seams, buttonholes, pockets, etc. Special electrodes have been developed producing buttonholes which do not tear. The machine seems to be of importance for the manufacture of raincoats and handbags, but also has uses in the packaging industry. Any decoration can be impressed on handbags by the use of special electrodes.

The high capacity injection moulding machines developed in England by R. H. Windsor were exhibited by R. E. A. Bockholdt, Herford i. Westf. Hard metal tipped tools for the plastic industry were shown by Hochleistungs-Werkzeug-Gesellschaft, Bremen. E. Winter and Sohn demonstrated the sawing of plastic sections (extruded phenol-formaldehyde materials) by means of a diamond prepared sawing blade, on a special sintered carbide sawing machine with a wheel diameter of 4 ins. Bakelite-bonded diamond grinding wheels of $1\frac{9}{16}$-in. diameter are used in small special driving units for the sharpening of sintered carbide chisels, as used by watchmakers and precision mechanics.

The sides, floor and ends of the body of this "Streamlite" caravan, by Alperson Products Ltd., The Avenue, Newmarket, Suffolk, are built of natural "Holoplast." The interior walls are of sycamore-veneered lining "Holoplast," and the furniture is mahogany-veneered grade.

Plastics in a London Showroom



This spiral staircase from the ground floor to the mezzanine showroom at Finnigans Ltd., New Bond Street, London, is of aluminium and has a circular showcase at the mezzanine floor-level constructed of aluminium tee and angle framing and glazed with clear "Perspex." The floor of this showcase is white opalescent "Perspex," illuminated from underneath. The semi-circular display platform on the ground floor is constructed of 1-inch "Holoplast" flush jointed on light metal framing with steel riser and aluminium edging.

Engineer craftsmen: J. Starkie Gardner Ltd.

Architect: F. G. Thomas, F.R.I.B.A.

Cellulose Acetate Plastics

XXIII.—Applications

By
Vivian Stannett

EARLIER sections of this series have described some of the numerous ways in which cellulose acetate plastics can be manipulated in order to form a multitude of different shapes and articles. This versatility in the methods available for fabrication is one of the most attractive features of cellulose acetate and has, together with its other properties, led to an astonishingly wide variety of uses and applications.

In addition to the methods of moulding, extruding, forming, and so on, which have already been discussed, a great deal of cellulose acetate is also used in the form of laminates with other materials to give a combination of properties of great advantage for certain applications. In this connection it should be noted that for many years one of the chief outlets for cellulose acetate sheet was as the interleaving medium for laminated safety-glass manufacture. Although the term laminate is often defined[1] as " the product formed by bonding together two or more layers of a material or materials," it is convenient to also include certain impregnation processes, such as will be mentioned later. Materials with which cellulose acetate is being laminated on a commercial scale currently include glass, paper, card, textiles, aluminium and wood. Some comparative properties of these materials are given in Table 1.

Several methods are available for laminating with cellulose acetate sheet, but the most usual one is by pressure and heat combined, employing a hydraulic daylight press with heated plattens. This is, of course, a discontinuous process and consists of the following sequence of operations: The layers of cellulose acetate sheet and the other laminating medium, e.g., cloth, paper, etc., are built up and placed between two highly polished metal sheets and the whole assembly placed between the plattens of the hydraulic press. Up to three layers can often be treated in one pressing. If a dull, matted or embossed finish is required, matted or embossed metal plates are substituted for polished plates. Heat and pressure are then applied for some time, followed by cooling and finally releasing the pressure and removing the assembly. The resulting laminate is then trimmed by guillotine, hand-shears or band-saw..

A very common type of simple laminate[2] made by this method is a sandwich of paper or card between two layers of transparent cellulose acetate. The latter is normally of a thickness between 0.008 to 0.015 in. With this type of work, a temperature of 120 to 170 degrees C. and a pressure of 400 to 700 lb. per sq. in. of laminate are used. Fast time cycles of 5 to 10 minutes for the complete series of operations can easily be obtained, and up to four layers per daylight can be laminated in one pressing.

Table 1.—Effect of Miscellaneous Fillers on Properties of Laminates[4].

Type of Filler	Asbestos Paper	Glass Fabric	Kraft Paper
Number of layers	30	3	25
Izod impact strength, ft./lb./in. notch, edgewise	3.7	>14.9	1.7
Flexural strength, lb./sq. in.	19,400	8,500	17,900
Tensile strength, lb./sq. in.	23,100	25,800	14,500
Elongation, %	1.86	2.8	2.5
Modulus of elasticity in tension, lb./sq. in. x 10^3	1,890	1,160	1,000
Water absorption (100% R.H., 168 hrs., 77°F), %	4.4	3.34	5.6

Fig. 1. — Cellulose acetate laminated to light cotton scrim in use as window fitment by hospitals. (Courtesy, Eastman Kodak Co. N.Y.)

If the centre paper or card layer is trimmed smaller than the cellulose acetate, a complete seal results, i.e., the overlapping edges of the plastic flow together completely enclosing the centre piece. This gives complete protection and provides a permanent, washable, tamper-proof and wear-resisting finish.

In the United States, official miniature military discharge vouchers and alien registration cards are among the official documents issued laminated in cellulose acetate transparent film. During the war valuable documents were also sealed in this way for purposes of preservation. Commercial applications include photographs, club membership and business cards, whilst identity discs for the workers in some Middle East oilfields are also protected in this way. For most of the above types of work small portable laboratory-type presses are used, with built-in oil pumps and steam-heated plattens which are also fitted for water cooling. With this simple type of press the lamination can be carried out by the user's office, which is necessary for document and identity card work.

Fig. 2. — Cellulose acetate laminated to aluminium foil is employed as a wrapping for photographic plates. (Courtesy, Eastman Kodak Co., N.Y.

The time cycle for performing such a lamination depends to some extent on the grade of cellulose acetate sheet used, as does the temperature and pressure required to give a complete weld. The plasticizer content of the sheet is particularly important; in general, the higher the percentage of plasticizers, the lower need be the temperatures and pressures. This is a useful point to remember if the paper or other laminating material tends to discolour or "yellow" at elevated temperatures. The quality and surface of the paper used are also of importance; a rough-finish paper produces the best laminate, as a polished paper does not provide the open-fibre structure into which the softened plastic can flow to give a firm seal.

The production cycle can be speeded up somewhat by the use of two sets of plattens in the same press, one set cooled and the other heated. The assembly of sheets is placed between the hot plattens and pressed, and then the press is opened and the assembly moved to the cold set, whilst a fresh sandwich is placed between the heated plattens. Pressure is then applied again, and the process continues. This method is very convenient for small presses, and the changing over procedure can be made very easy by using some kind of lifting clamps to change over the plates. With larger areas, difficulty is sometimes experienced due to inequalities of pressure, and this may lead to a haziness across one section of the laminate or to only partial lamination. To overcome this, the plattens need to be carefully levelled and the polished metal plate cushioned on a few layers of paper or, better, an especially hard grade of cellulose acetate sheet plus paper.

For some purposes, such as calendars and advertising cards, only one surface of the paper needs to be coated with plastics; this can be carried out using a similar method. However, such combinations tend to curl on removing from the press and are normally only suitable for uses where they can be firmly clamped in position, as in a crimped metal frame for display purposes.

Thin Film Laminates

A number of applications have been developed making use of a combination of very thin cellulose acetate film (of approximate thickness range .001 to .005 in.) and paper. For this type of work a continuous process has been developed by a number of fabricators. The exact conditions have not been made known, but essentially the process consists of feeding the paper and cellulose acetate together through a set of laminating rollers, the paper having previously been coated with a suitable adhesive. This can be carried out just prior to the two materials joining as they enter the rolls. In this way, for example, a viscous solvent-type cement could be used. Uses which have been established for this type of laminate include the following:—

(1) **Electrical insulation work.** Here a special electrical grade of paper is used in combination with a high acetyl value cellulose acetate film. This type of laminate was manufactured in some quantity in Germany before the war.

(2) **Laminated wallpaper.**[3] Normal printed wallpaper is coated with a thin acetate film in order to render it washable and stainproof. A matted surface is imparted to the film in order to make its presence inconspicuous and to give it a non-reflecting surface. This plastic-coated wallpaper should find application in hospitals, nurseries, etc.

(3) **Laminated labels.**[4, 1] For this purpose a highly polished surface film is preferred. The acetate film used for covering labels is less than .001 in. thick and is itself printed, using a special photogravure process. Special presses have been developed which laminate the printed film to the paper during one turn through the press. The labels can then be cut out of the continuous sheet by guillotine or die-cut methods. Labels made in this way have been used in the hard-liquor and cosmetic trades.

Cellulose Acetate Cloth Laminates

The combination of cellulose acetate and cloth has been found to be of commercial interest for a number of reasons.

Table 2.—Cellulose Acetate Thermoplastic Laminates[5].

Properties compared to those of unreinforced cellulose acetate and thermosetting plastics.

Tests Made	A.S.T.M. Test No.	Cellulose Acetate Test Pieces						Thermosetting Phenolic Laminate Test Pieces [3]	
		Soft		Medium		Hard			
		Plastic	Laminate	Plastic	Laminate	Plastic	Laminate	Grade C	Grade LE
Specific gravity	D71-27	1.26	1.31	1.32	1.33	1.32	1.33	1.35	1.34
Hardness, (Rockwell R scale)		TS[4]	34	75	52	100	63	95 (M Scale)	113 (M Scale)
Izod impact strength [1]	D256-43T	4.0	7.3	2.5	4.7	2.9	5.5	3.9	1.8
Izod impact strength [1] ft.-lb./inch of notch	D256-43T	9.9	18.3	6.1	11.6	7.2	13.8	9.7	4.5
Water absorption immersion test:									
% loss on drying before imm.	D570-42	0.9	2.2	0.86	1.66	1.23	1.60	2.00	2.26
2 hrs. imm. % gain	D570-42	0.5	0.91	0.47	1.40	0.59	1.40	0.42	0.91
24 hrs. imm. % gain	D570-42	−2.4	2.5	1.9	4.79	2.45	4.7	2.0	3.2
48 hrs. imm. % gain	D570-42	−3.9	2.83	2.59	6.2	3.43	6.2	2.7	4.2
Water absorption 100% RH[2] 77°F:									
24 hrs. −% gain		1.42	3.62	1.89	3.15	1.37	2.22	1.78	2.06
48 hrs. −% gain		1.04	4.43	2.92	4.22	2.03	3.36	2.57	2.99
168 hrs. −% gain		−3.78	4.82	4.87	7.44	4.36	6.80	4.93	5.81
Tensile strength lb./sq. in.	D638-42T	500	4,300	4,600	6,400	7,200	8,040	8,500	8,000
Elastic modulus in tension, lb./sq. in.	D638-42T	16	79,000	137	310,000	260	370	890	850
Flexural strength, lb./sq. in. × 10^3[4]	D648-41T	680	1,600 36	40	47.5	9,600 54	10,400 54	13,000 145	22,000 126
Distortion under heat °C									
Thermal conductivity cal/sec/sq. cm./°C/cm × 10^{-4}	D325-31T	4.9	7.4	4.8	6.6	3.8	5.4	5.0	4.4
Thermal expansion in/in. °C × 10^{-5}	D696-42T	20	6	14	5	11	3	1.9	2.9
Elongation, %	D638-42T	75	10	40	8	26	8	3.2	1.3
Dielectric strength (Step by step 25°C): (60 cycles-volts/mil):									
Dry		880	100	1,180	1,140	1,250	1,130	880	1,000
Wet [4]		670	85	940	75	1,150	660	60	240
Power factor (60 cycles-25°C)									
Dry		.207	.299	.024	.103	.025	.080	.465	.34
Wet [4]		.063	>.70	.21	>.70	.141	.109	>.70	.66
(1,000,000 cycles-25°C)									
Dry		.043	.051	.049	.058	.031	.043	.060	.057
Wet [4]		.032	.132	.059	>.30	.045	.133	>.30	.122
Dielectric constant (60 cycles-25°C):									
Dry		6.8	8.2	5.2	6.7	5.0	5.6	21.8	12.9
Wet [4]		15.1	>30	8.4	>30	7.9	16.4	>30	>30
(1,000,000 cycles-25°C):									
Dry		6.4	6.0	4.4	4.6	4.2	4.4	5.5	5.2
Wet [4]		7.5	13.1	6.6	13.5	6.4	9.6	10.0	6.8

[1] ft. lb./in. of notch. Specimens, ½ in. thick, were stacked ½ in. high and run edgewise. [2] Tested on Tour-Marshall. by cantilever beam method. [3] Tests conducted on commercial laminates ½ in. thick. [4] Too soft. [5] Relative humidity. [4] Wet specimens were immersed in water for 7 days at 25°C and then tested.

The strength of normal cellulose acetate sheeting can be as much as trebled by laminating with a suitable fabric. Also, using a printed or coloured woven fabric with transparent acetate sheet, very beautiful materials can be obtained. This is particularly true with an open-weave type of fabric, when a deep, three-dimensional effect is produced. With opaque acetate sheets, of course, the sole use of the fabric is for improving the physical properties of the plastic.

A complete comparison of properties between straight cellulose acetate sheet and the same laminated with 8 oz. drill cloth based on a 70 to 30 plastics/cloth ratio is given in Table 2, together with some comparative figures for two grades of phenolic laminates.[5, 6, 7] It can be seen that the acetate laminate compares favourably with phenolic in most respects and has a superior impact strength in every case. The effect of varying the type of cloth used is shown by the figures given in Table 3.

Several methods of producing the cloth laminates are available. One standard method is by simple heat and

Table 3.—Effect of Fabric Type on Properties of Thermoplastic Laminates[6]

(Ratio of cellulose acetate PH-1 to Santicizer M-17, 75 to 25; ratio of plastic to cloth, 70 to 30)

Type of Cloth	Airplane	Balloon Basket Weave	Chafer Duck	Chafer Duck	Hose Duck	Harvester Duck	Drill Cloth
Count	80 × 80	104 × 98	35 × 25	23 × 23	26 × 22	32 × 16½	—
Breaking strength							
A.S.T.M. raveled strip method	80 × 80	120 × 120	—	—	—	—	—
A.S.T.M grab method	—	—	92 × 61	201 × 191	119 × 122	546 × 432	—
Weight, oz./yd.	4.0	5.6	5.6	14.0	9	31.5	8
No. of layers of cloth	8	6	6	2	3	1	4
Izod impact strength, ft. lb./in. notch, edgewise	2.7	3.4	2.5	3.6	3.5	5.2	5.5
Flexural strength, lb./sq.-in.	16,500	17,200	14,000	12,400	12,100	12,700	10,400
Tensile strength, lb./sq.-in.	11,200	15,100	8,700	7,300	8,000	7,400	8,040
Elongation, %	6.9	3.5	4.5	7.6	6 6	11.9	8
Elastic modulus in tension, lb./sq.-in. × 10^3	900	1,000	610	430	440	350	390
Water absorption (100% R.H. 168 hr. 77°F), %	5.7	6.4	7.0	7.2	7.2	6.5	6.8

Table 4.—Properties of Cellulose Acetate Cloth (Osnaburg 8 oz./sq. yard.) Laminates made by Solution Method[6].

Property	A.T.S.M. Method	Overall Results
Izod impact strength ft./lb./in. notch, edgewise	D256—41T	6—10
Tensile strength, lb./sq.-in.	D638—42T	1,300—4,400
Elastic modulus in tension lb./sq.-in.	D638—42T	15,000—170,000
Elongation, %	D638—42T	8—15
Water absorption	D570—42	6—12
Water absorption (100% R.H. 168 hrs. 77°F), %	—	10—12

pressure treatment in a hydraulic press, as described above for paper and card laminates. The need for reducing the cost of production has led to a tendency away from this process to one using moulding powder rather than the more expensive cellulose acetate sheet. One such process was described in 1947.[8, 9]

In this process a long endless stainless-steel belt, similar to those used for film casting, is employed. Finely ground cellulose acetate moulding powder is continuously fed on to the moving belt by a vibrating feeder box, and as the belt moves round it carries the evenly spread powder through a section heated to around 400 degrees F. by a battery of infra-red lamps. This causes the powder to flow and become a sticky layer on the steel band. On emerging from the heated section, this layer is brought into contact with the laminating cloth, which is fed on to, and hard against, the band from feed rollers. The sticky plastic picks up the cloth and carries it round with it, and when the plastic has become cool again, cloth plus plastic can be readily and cleanly stripped from the band by tension rollers and cut into sheets.

These sheets can then be laminated together to the required thickness, using a normal daylight hydraulic press as before. Such cloth laminates can be formed and drawn at a temperature of 325 degrees F. or so; preheating can be carried out using infra-red lamps or by hot-air oven.

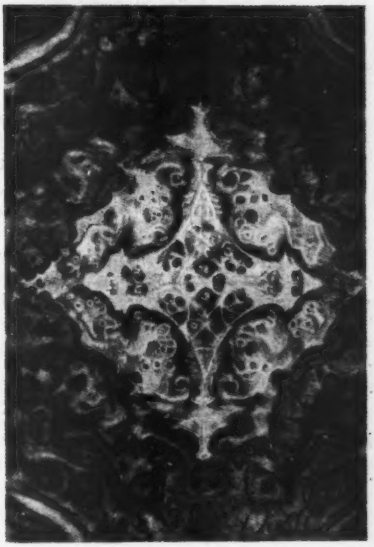
All kinds of fabric, including rayon, can be laminated in this way. Uses to which this material can be put include suitcases, radio cabinets, loudspeaker housings, typewriter cases, lampshades, and inside linings for car doors. The strength of these laminates is similar to those given in Table 3, and a perusal of the properties given in this table will bring to mind some of the possible uses for this material.

Other methods[9] which have been described appear to laminate directly in the press using moulding powder plus fabric (cotton, rayon or woven paper). A very different type of method employs a

Figs. 3 and 4. — Examples of wood grain patterns printed or cellulose acetate film for use as veneer. (Courtesy McCorquodale Ltd. and Utilex Ltd.)

solution of cellulose acetate plus plasticizer, and the application of this to the fabric can be carried out in a number of different ways. A simple method is to pass the fabric or paper from a roll through the solution of cellulose acetate, allow the soaked fabric to dry, cut into lengths, and laminate several of these sheets together, using a hydraulic press as before. The preparation of a simple laminate such as the cotton scrim-cellulose acetate material used as a window covering is very straightforward. Provided the material is kept taut throughout the preparation and drying, this can be made by simply passing the scrim through the cellulose acetate solution and drying under tension. Under these conditions a very reasonable transparency is obtained.

A rather better way of coating a thin open material, such as cotton scrim, is to feed the cloth on to the moving band of a film-casting machine and cast a film of transparent cellulose acetate on top of it. Under the correct conditions an excellent finish can be obtained and many thousands of yards of window covering have been successfully produced by this technique, especially during the war for use as a protective covering. The high ultra-violet light transmission of cellulose acetate has led to extensive use of this "glazing" material for hospital windows and also for applications in the garden, such as in poultry runs, frames and greenhouses. This product can also be



made discontinuously by laminating the scrim between two layers of cellulose acetate film between polishing plates in a hydraulic press, as described above. An example of this type of window material is seen in Fig. 1.

Simple shapes can be built up of cellulose acetate/fabric laminations by simply laying the cloth on a mould and painting cellulose acetate dope over it and allowing it to dry. Further layers can be built up in the same way to the required thickness. Lampshades can be

readily made in this way, using, for example, a decorative print or woven fabric and transparent cellulose acetate. If desired, a lampshade can be made up using the same design material as is used for the couch and chair covers, and so on. Paper can be substituted for cloth in this process, but with considerably less æsthetic appeal and with poorer wearing qualities.

Wooden, metal or plaster moulds can be used which are preferably covered with "Cellophane" to give easy removal of the laminate after drying. An interesting example of this method of manufacture is its use for the production of geographical globes; these can be made by using a hemispherical mould, covering with cloth and painting with cellulose acetate dope, as above. After this is dry, the paper map is mounted, using cellulose acetate cement, and finally painted over with acetate lacquer to protect it from scratching and staining. The two halves can be made separately and flanged and cemented together.

Some idea of the mechanical properties of these solution-made laminates can be gathered from the figures given in Table 4, which are overall results taken from a number of measurements. It can be seen from this table that, although water absorption and tensile strength are less than with pressure laminates, the impact strength is very high. Also, the material is much lighter in weight than its pressure-made counterpart and the moulds and equipment necessary for the production of simple shapes by the solution method are extremely inexpensive and readily adaptable to changes in shape and colour design.

Spectacle frames, and the tops and bottoms of heavy-gauge transparent containers, are among novelty uses for fabric pressed between two layers of transparent acetate. In the case of spectacle frames, the frame is stamped out of the laminate and the edges of the cloth interleaf are sealed in by painting with transparent cellulose acetate dope.

Before leaving the subject of cloth laminates one should be reminded that

Fig. 5. — Cellulose acetate/cloth laminate is used for this vacuum flask carrying-case. (Courtesy, Hercules Powder Co.)

cost is a very important consideration in choosing a particular laminate, and this is one reason why cellulose acetate laminates have not yet come into wider use. In addition to the initial cost of the plastic, the amount of trimmings lost during preparation and fabrication must be taken into account as, unlike with normal acetate production, here the trimmings are practically irrecoverable. Furthermore, when operating a solution or wet method of production solvent costs are liable to be high unless an efficient solvent recovery method is available.

Laminated Safety Glass[10, 11, 12]

Cellulose acetate succeeded celluloid as the chief material for the interleaf in safety glass in 1934, and held this position until about 1942 or so, when it was displaced by polyvinyl butyral sheeting. To-day this latter material is used in most safety glass, although a small percentage is still made with cellulose acetate. The main reasons for the change-over from cellulose acetate were its poor impact strength at low temperatures and its poor water resistance. This means that when

the sheet is cut, the edges have to be sealed with a water-resistant resin, such as bitumen, or else discoloration and delamination tend to occur. This additional operation is not necessary in the case of polyvinyl butyral.

Using a suitable adhesive, excellent adhesion between the cellulose acetate and the glass can be effected. The sequence of operations in the manufacture of safety glass is as follows: The glass plates are cleaned and sprayed with adhesive; they are then assembled with the plastic interleaf in a bath of plasticizer, which replaces all the air between the layers. The sandwich is then subjected to heat and pressure either in a hydraulic press or in bulk in a suitable autoclave. For most safety glass, a cellulose acetate sheet containing about 40 per cent. of dimethyl phthalate as plasticizer is used.

Miscellaneous Laminates

Aluminium can be successfully laminated to aluminium foil, using a special synthetic resin solution-type cement. This combination makes a splendid wrapping material and has been used for soluble coffee, dehydrated foods, and for certain chemicals, including photographic materials (Fig. 2). A bright metallic thread,[14] which is non-tarnishing, has been prepared by pressing aluminium thread between two layers of acetate film and has been used for special textile purposes, and corresponding ribbons have also been made. Heavy reinforced acetate sheet[13] for outdoor use in greenhouses or for stockroom windows, etc., is made by pressing wire mesh between two layers of cellulose acetate in a hydraulic press. This material is unbreakable, heat-retaining, and ultra-violet light transmitting.

Printed cellulose acetate film can be pressed on to wood to give a permanent washable coating. An interesting and unique application of both the printing and laminating properties of cellulose acetate film has been the successful production of wood veneer. This has been achieved by the printing in reverse of the pattern of wood grain. By this means film with beautiful wood-grain designs can be obtained (Figs. 3 and 4), and this can then be attached as a veneer to plywood or other surfaces and used for panelling, wireless cabinets and other purposes. Actual natural wood grain can be photographed and printed on to film by a special technique, and expensive and rare woods can readily be copied by this means. Panels can be prepared using this method which have the additional advantage of exactly matching one another; normally, great efforts have to be made to obtain panels with matching grain, colour and pattern. To give a firm adhesion to the wood, a highly plasticized film of special composition is necessary.

REFERENCES

(1) "*Modern Plastics Encyclopedia*," 1949. (2) "*Modern Plastics*," 1946/**23**(7)/188. (3) "*Modern Plastics*," 1948/**25**(1)/88. (4) "*Modern Packaging*," 1947/**20**/168. (5) "*Hercules Cellulose Acetate*" (*Hercules Powder Co.*) (6) *Eurenius, Hecht, Koch and Malpass*, "*Ind. Eng. Chem.*, 1945/**37**/959. (7) "*Modern Plastics*," 1948/**25**(12)/117. (8) "*Modern Plastics*," 1947/**24**(6)/91. (9) "*Modern Plastics*," 1948/**25**(8)/119. (10) *R. N. Haward in* "*Plastics Applied*," *edited by V. E. Yarsley* (*National Trade Press*, 1945). (11) *J. Wilson*, "*J. Soc. Glass Tech.*," 1936/**20**/35. (12) *J. B. Watkins*, "*Ind. Eng. Chem.*," 1932/**24**/1,187. (13) "*Modern Plastics*," 1946/**24**(4)/110. (14) "*Modern Plastics*," 1946/**24**(3)/121.

B.S.I. YEARBOOK.—The 1949 Yearbook of the British Standards Institution, just published, gives a subject index and a synopsis of each of the 1,500 British Standards now current. These standards have been prepared by representative committees of 55 different industries. The Yearbook also includes lists of members of the General Council, Divisional Councils, and Industry Committee, as well as other useful information about the work of the Institution. Copies, price 5s. post free, can be obtained from the Sales and Distribution Department, British Standards Institution, 24, Victoria Street, London, S.W.1. A subject index of the list of British Standards may be obtained separately at the published price of 1s. 6d.

PLASTICS IN GERMANY

The New Target in Germany is the Science behind the Industries. The following are additional Notes from the Official Reports which can be obtained from H.M. Stationery Office.

B.I.O.S. Final Report 999.—Manufacture and fabrication of p.v.c. at Bitterfeld is the subject of this detailed report, which is complete with drawings of the separate sections of the plant, and a comprehensive list of the equipment included. Regarding fabrication, some useful data is included upon rolling the p.v.c. into rough sheets, manufacture of foils by calendaring, manufacture of press-polished thick sheets, the making of extruded sections by ram or screw extrusion (the latter, in particular, of bristles), and compression moulding. Some further notes relate to the machining and welding of semi-fabricated products, the jointing of pipes and the lining of tanks.

B.I.O.S. Final Report 1754.—Melamine production by the isobutanol process is the subject of this report. The production of melamine in Germany has already been mentioned in B.I.O.S. Final Report 667 and C.I.O.S. Item 22, File No. XXIV-21; utilization in synthetic adhesives was covered by B.I.O.S. Final Report 456; manufacture was dealt with specifically in F.I.A.T. Final Report 886. The present report, apart from giving fuller details of the isobutanol process, also deals with a process of manufacture in which no solvent is used. A solution of dicyandiamide in liquid ammonia is introduced continuously over a period of hours into an autoclave at 180 degrees C., which has been previously charged with ammonia to give a pressure of 40 atmos. The pressure is maintained at this level by allowing the superheated ammonia vapour to escape continuously through a control valve. The important feature of the process is that the evaporation of the liquid ammonia in the autoclave removes a considerable quantity of heat from the system which counteracts the heat of reaction evolved in the conversion of dicyandiamide to melamine. Good temperature control is thus achieved, and the whole system never exceeds a working pressure of 40-50 atmos. Opinion is divided as to the advantages offered by comparison with the existing isobutanol process.

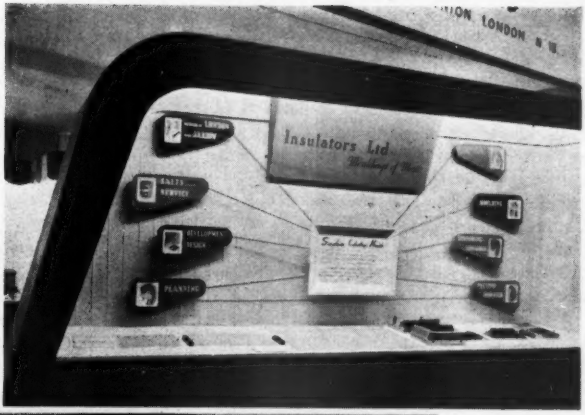
B.I.O.S. Final Report 1788.—Manufacture of formaldehyde at the I.G. plant at Leverkusen is described in this report. Methanol is dehydrogenated to formaldehyde in the presence of an approximately equal weight of water vapour which serves both to increase heat capacity of the reaction system and to provide water for absorption of the formaldehyde. Air is added to the methanol/steam mixture in order to provide the necessary heat of reaction by combustion of part of the hydrogen produced; a small proportion of the methanol is at the same time unavoidably burnt to carbon dioxide and water. The reaction is carried out at atmospheric pressure and in the temperature range 625-675 degrees C. in a bed of silver granules. The reaction products are cooled and scrubbed with water, and a 30 per cent. solution of formaldehyde is produced. The yield is 80-85 per cent. of theoretical.

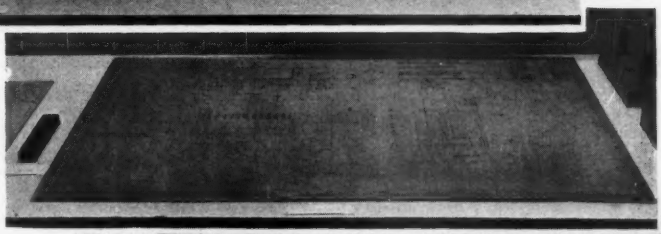
B.I.O.S. Final Report 1793.—This report gives details for the manufacture of certain plasticizers for p.v.c., namely dibutyl methylene dithioglycollate and dibutyl thiodiglycollate, of I.G. origin. There is also a note on the manufacture of sebasic acid from castor oil.

B.I.O.S. Final Report 1795.—This brief report on the manufacture of synthetic resin adhesives by Heinkel and Co. deals mainly with a melamine-formaldehyde resin called "Pressal," and cellulose glycol acid-ether ("Zell-heim"). The former was marketed in part as a 30 per cent. mixture of the resin with 70 per cent. of starch. The sodium salt of cellulose glycol acid-ether is stated to be a material of good binding power and has been used with considerable success for internal finishes for walls. It is mixed with chalk, or other basic material or colour, and applied to the wall in the form of a slurry. Before drying, it can be ornamented with any desired finish, and subsequently is lacquered.

B.I.O.S. Final Report 1811.—This report deals in great detail with the synthesis of acrylates by reaction of acetylene, carbon monoxide and alcohols. It includes a description of the pilot plant and method of operation, and general observations on catalysts, promoters, solvents, reactor sizes, output and yields, working up reaction liquid, recovery of catalysts, by-products, and analytical methods. There are also full translations of various patent applications relating to the acrylic ester synthesis, and also the synthesis of propionic acid. The manufacture of butyl acrylate with polyglycols as catalyst media and nickel bromide as catalyst is described.

Reflection from British Industries Fair, 1949





This exhibit, by Insulators, Ltd., depicted a service which offers specialized investigation into all plastic moulding problems. The company's 21 years' experience stressed assurance of the use of correct materials in conjunction with good design, and showed the progress of an order through all development stages, from the customer's first letter to completion.

LETTERS TO THE EDITOR

Printing on Cellulose Acetate

Sir,—We are dealers and consumers of celluloid and cellulose acetate sheets and are interested in importing the same from your country. We request, as early as possible, the addresses of manufacturers of these plastics in sheets. We require them in thicknesses from 0.010 in. to 0.10 in., polished on both sides, in different finishes.

We also wish to print on celluloid and cellulose acetate sheets to manufacture drawing instruments, such as protractors, scales, etc., and would be grateful to know a method we can use on a small scale and with minimum investment.

INDIAN UNIVERSAL INDUSTRIES.
Post Box 225, Delhi.

Dip Coating for Tools

Sir,—Can you please tell us the name of the manufacturers of the plastic dipping compound known as "Plastikote," which is used for covering the handles of tinman's snips, etc.

EDGWARE CUTLERY MANUFACTURERS, LTD.
Humber Road,
Cricklewood, London, N.W.2.

[EDITOR'S NOTE: "Plastikote" is an American product supplied by the Utica Plastic Coating Co. There are several British materials in use for the same purpose. Names have been sent.]

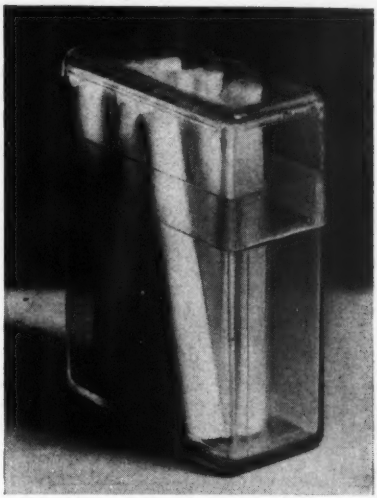
Switch Knob

Sir,—We are importers and agents supplying the electrical industry here in Norway. The large manufacturers in this country are now interested in a switch knob with a non-turning back plate equipped with the number scheme 0-1-2-3. This back plate would enable the range manufacturers to avoid the cumbersome transfer of this scheme direct to the porcelain enamel. If you know of any manufacturers of such switch knobs, kindly inform us in order that we can contact them.

HOLST AND FLEISCHER A/S.
Oslo, Prinsensgt, 1.

Cigarette Cases

Sir,—We have an inquiry from the British West Indies for a quantity of plastic cigarette cases made in the form of a box, to hold 20 cigarettes in American pack. It is an upright box



made in transparent plastic, with a pull-off lid. We should be greatly obliged if you could let us know the names of some manufacturers. ROY TALLENT, LTD.
70-74, City Road. E.C.1.

Brush Backs

Sir,—We would be grateful if you could put us in touch with a firm willing to supply injection-moulded brush backs in polystyrene or acetate.

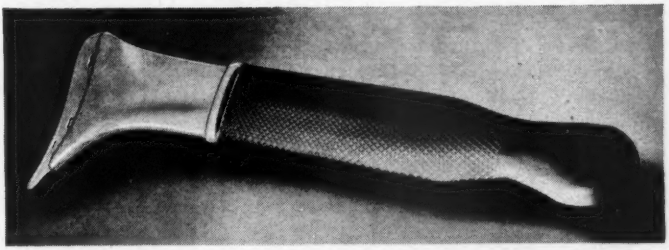
STRATFORD PRODUCTS (FANCY GOODS), LTD.
98, Tower Bridge Road, S.E.1.

Graduated Measures

Sir,—We are desirous of obtaining plastic measures with handle, graduated up 10 oz., and should be obliged if you could recommend suppliers.

COLGATE-PALMOLIVE-PEET, LTD.
371, Ordsall Lane, Manchester, 5.

New Productions from the Moulding Shops

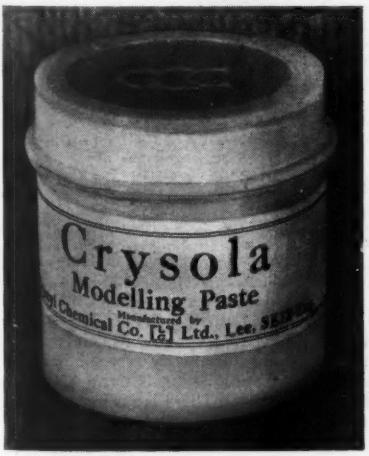


Saucepan Handle Covering

Since almost every handle we can think of should be of plastic or covered with it, whether as an electrical insulator, heat insulator or to improve its appearance, it is good to record that the saucepan handle shown is one that has been sheathed in hard p.v.c. by Creators, Ltd., Weybridge, Surrey. An interesting feature is the knurled surface of the p.v.c. and the introduction of a ridge in the metal handle, which provides a more finished appearance to the job.

Appropriate Container

Here is a sensible container for the particular job. It is of polythene and holds a new modelling paste for the production of "barbola" and similar work. The paste, manufactured by Crystyl Chemical Co., Ltd., Lee, London, S.E.12, contains a phenolic resin of special properties, hence it cannot be packed in conventional metal containers, with the exception possibly of pure aluminium. The polythene is unbreakable, extremely corrosion resisting, and has considerable sales appeal. The injection moulding has been carried out by McMurdo, of Ashtead, Surrey.

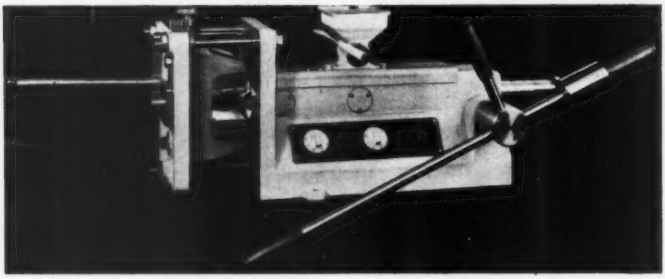


Battery Box

A new development in the commercial and passenger service vehicle field is the employment of monobloc containers, moulded in shock resistant and acid-proof ebonite, for "Exide-Ironclad" and "Exide" batteries. These containers are extremely strongly constructed, being strengthened at the more vulnerable points, with reinforced lifting handles moulded integrally with the container. Each container, before being sent from the works of the Chloride Electrical Storage Co., Ltd., is subjected to a high voltage dielectric test to ensure perfect insulation and complete absence of flaws.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

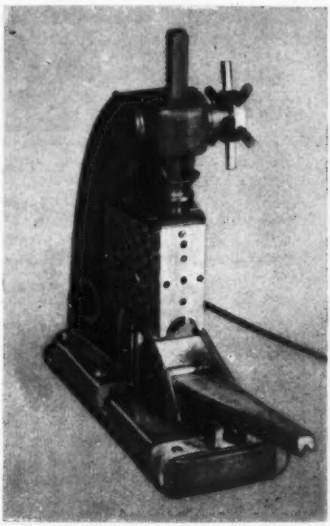


(Above) The "Plasticor" hand-operated injection moulding machine by Davidsons (M/C), Ltd.

NEW INJECTION MOULDING MACHINES.—Two new hand-operated machines for injection moulding have been brought to our notice and are here illustrated.

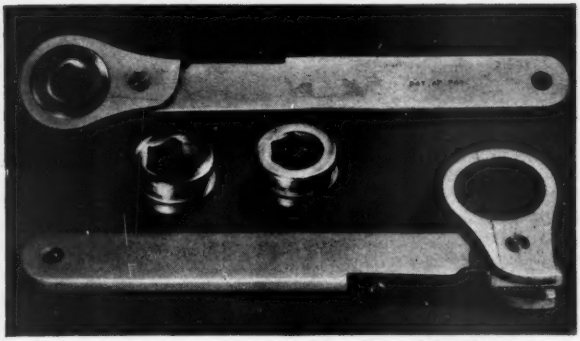
The "Plasticor" machine, capacity ½ oz., is the subject of provisional patents, and is being made by Davidsons (M/C), Ltd., Hayes Yard, Garratt Street, Oldham Road, Manchester, 10. It is a compact machine with adjustable balanced handles to supply ample pressure with ease of operation for working all thermoplastic materials. The taper self-lock die unit, with positive action and mould alignment, is a special feature. The horizontal, retractable and completely interchangeable injection chamber is fitted with a specially designed torpedo for maximum efficiency. Heaters are thermostatically controlled. The hopper (capacity 1 lb.), is of the self-metering type, with transparent cover for visual inspection, and is heated to ensure the drying of material previous to entering the chamber. The heating units take 450 watts, and operate from a 230/240 A.C. supply.

The smaller machine has been introduced by Asmidar, Ltd., 5, Rampayne Street, London, S.W.1. Its capacity is 12 grams per shot with a nozzle pressure of 400 kg. per sq. cm. The heating element takes 70 to 180 watts, and is connected to a 110-120-volt supply. The overall height of the machine is only 35 cm., but it will normally accommodate moulds up to 6 cm. by 6 cm. An eccentric toggle-lock adjustment is incorporated for maximum mould clamping pressure. The machine is suitable for working cellulose acetate, polystyrene and polyvinyl chloride.



Hand-operated injection moulding machine by Asmidar, Ltd.

IMPROVED SPANNER. — The "Halway" ratcheting spanner, which is illustrated, embodies an entirely new method of obtaining ratcheting action (Patent Application No. 5027/49). There is no lost motion as with a ratchet and pawl mechanism. The spanner is silent in action, and non-slipping;



(Left) The "Halway" ratcheting spanner (E. R. Lattimer, Ltd.).

(Below) The "Poole" explosimeter (Oldham and Son, Ltd.).

the harder the pull, the tighter is the grip. Nut-rings of different sizes fit into the same head, and these can be changed in four seconds. From our examination of the tool we honestly believe that it will prove to be the most efficient ratcheting spanner yet produced, and that it will last the user a lifetime. Three sizes are at present available, covering a range of nut sizes up to $\frac{1}{2}$-in. Whit. or $\frac{9}{16}$-in. B.S.F. Manufactured by E. R. Lattimer, Ltd., Shakespeare Street, Southport, Lancs, the sole distributors for Great Britain are George H. Alexander Machinery, Ltd., Coleshill Street, Birmingham, 4.

EXPLOSIMETER.—This new instrument, the subject of one of our illustrations, provides a simple means of testing the liability to explosion of an atmosphere containing a mixture of inflammable gas or vapour. It was exhibited at the B.I.F. by Oldham and Son, Ltd., Denton, Manchester.

The "Poole" explosimeter operates on petroleum vapour, coal gas, acetylene, methane, hydrogen and hydrocarbon gases such as butane, pentane, octane, etc. It is sufficiently sensitive to detect mixtures well below the lower explosive limit, indeed, in concentrations as low as 0.02 per cent. by volume. In use, the instrument is carried about, suspended by shoulder straps. A sample of the atmosphere, drawn into the instrument by means of a rubber aspirator, passes into a gas chamber containing a dual filament unit which forms part of a Wheatstone Bridge circuit. One filament is operated at a temperature high enough to permit it to act as a detector, whilst the other filament works at a low temperature and compensates for variation of atmospheric temperature, pressure and humidity. The uncompensated effect of the gas upon the detector causes a current to pass through

the meter, indicating the explosibility of the atmosphere which is under examination.

NEW THERMOPLASTIC RESIN, "Claromene," by Dorman, Long and Co., Ltd., By-Products Department, Middlesbrough, is an aromatic hydrocarbon-formaldehyde condensation product, introduced for binding and proofing products. It is available over a melting point range of 80 degrees C. to 130 degrees C, (ring and ball). Solubility is dependent on melting point; the higher the melting point the less is the solubility. All grades are soluble in tetralin, turpentine and carbon tetrachloride; low melting point resins are completely soluble in aromatic solvents and partially soluble in esters. The product, however, is not soluble in linseed oil and other drying oils, white spirit, or alcohols. It is compatible with coumarone/indene resins, colophony and many oil soluble phenolics, but not with coumarone/styrene resins. "Claromene" resin is used in the formulation of plastic tiles, adhesives, and chemically-resistant coatings.

BIRTHDAY HONOURS.—Awards in the King's Birthday Honours List included the following:—

Laurence Pierce Brooke Merriam, M.C., managing director of BX Plastics, Ltd., and examiner of controls to the Board of Trade —knighthood.

Thomas Harold Gant, F.R.I.C., chief engineer, British Industrial Plastics, Ltd.— M.B.E.

SOLVENTS DECONTROLLED. — The Board of Trade announce that the Molasses Order, 1949, has been made releasing industrial (ethyl) alcohol, butyl alcohol, acetic acid and acetic anhydride from control on June 1, 1949. These products, which have a wide use throughout industry, have been subject to control since September, 1939, and to Government ownership for the greater part of the time since that date. The ending of control will be accompanied by reversion to private trade.

RENNET CASEIN PRICES.—The Board of Trade announce that, as from July 1, 1949, the selling price of rennet casein will be reduced from £160 per ton to £120 per ton.

GAUGE AND TOOL MAKERS' ASSOCIATION.—Following the annual general meeting on June 29, 1949, Mr. F. W. Halliwell, chairman and managing director of Gay's (Hampton), Ltd., was re-elected President of the Association for the new session, 1949-50; Mr. H. S. Holden (Brooke Tool Manufacturing Co., Ltd.), chairman; Mr. A. L. Dennison (Birmingham Tool and Gauge Co., Ltd.), vice-chairman; and Mr. R. Kirchner, A.M.I.Mech.E. (Arnott and Harrison, Ltd.), hon. treasurer.

RUBBER ADHESIVE MANUFACTURERS.—The British Rubber Adhesive Manufacturers' Association, Court Chambers, Fair Lane, Leicester, have elected the following officers for the ensuing year:—Chairman: Mr. D. E. Cameron (B.B. Chemical Co., Ltd.); vice-chairman: Mr. B. Lawson (F. H. and H. S. Pochin, Ltd.); executive committee: Messrs. N. G. Bassett Smith (Dunlop Special Products, Ltd.), F. C. Campling (Goodliff Manufacturing Co., Ltd.), H. Clayson (The Excel Polish Co., Ltd.), F. F. Pratt (F. F. Pratt and Co.), V. H. E. Surridge (Surridge's Patents, Ltd.); secretaries: A. C. Palmer and Co., chartered accountants, Leicester.

ALBRIGHT AND WILSON, LTD., announce that they will shortly be in a position to supply commercial quantities of trixylenyl phosphate (T.X.P.). This material is a useful plasticizer for p.v.c., cellulose derivatives and other polymers. It is water-white, free from odour and has a very low volatility; the volatility is lower than that of tricresyl phosphate and dibutyl phosphate. When plasticized with trixylenyl phosphate, p.v.c. possesses good electrical and flame-resistant properties.

A. BOAKE, ROBERTS AND CO., LTD., announce that reductions in price are being made in respect of butyl alcohol, butyl acetate, ethyl acetate and amyl acetate. The new basic prices per ton, for quantities of 10 tons, are as follows:—Amyl acetate, technical, £171 10s. Butyl acetate B.S.S., £149 10s. Butyl alcohol B.S.S., £145 10s. Ethyl acetate B.S.S., £103 10s.

MICANITE AND INSULATORS CO., LTD., announce the appointment of Mr. A. Harrison, formerly chief assistant to Mr. F. L. Dinenage, manager of their Midlands office in Birmingham, to the position of sales representative for Wales and South West England, a temporary office having been opened at St. Martins, Hollybush Road, Cyn Coed, Cardiff (Phone: Llanishem 1196). Mr. G. Brown has been appointed to succeed Mr. Harrison as chief assistant to Mr. Dinenage, in the Midlands.

ASHDOWNS, LTD., Eccleston Works, St. Helens, Lancs., have commenced to issue, under the general title "They Asked Ashdowns," a series of leaflets concerning mouldings of particular interest which the company has produced. One of these leaflets relates to the housing of the stud welding gun which was described and illustrated in "Plastics," March, 1949 (page 120).

COMMERCIAL PLASTICS, LTD., announce that Mr. N. J. Gliksten has resigned from the board of directors, with effect from July 1.

THOMAS DE LA RUE AND CO., LTD., announce the following staff changes in their Plastics Division:—Mr. W. F. Campling will assume control of all factories of the Plastics Division. Mr. E. A. Davis, present technical manager of the Plastics Division, is appointed manager of the technical sales development department as from July 1; he will continue to supervise the Research and Development department at Tynemouth. Mr. H. Kelly has been appointed technical manager of the Plastics Division; Mr. F. S. Inglis, works manager of the Tynemouth factory; Mr. S. Dow, assistant works manager of De La Rue Extrusions, Ltd., and De La Rue Floors and Furnishings, Ltd., and Mr. G. Hill, works manager of the Fabrication Unit at

Cricklewood (formerly Hill, Norman and Beard Plastics, Ltd.). Mr. Harry Gordon will continue as sales manager of the decorative sales section. Mr. F. T. Fletcher has been appointed sales manager of the industrial sales section; Mr. G. C. Morrison, sales manager of the section dealing with all types of industrial sleevings, covered wires, Traffolyte engraving materials and Traffolyte interlaminate printed material; Mr. D. Sullivan, sales manager of De La Rue Extrusions, Ltd., and De La Rue Floors and Furnishings, Ltd.; Mr. F. G. Cooke, manager of the design section, and Mr. B. C. Randall, special technical representative for the transport and allied industries, as regards the Plastics Division.

SURRIDGE'S PATENTS, LTD., Croydon Road, Elmers End, Beckenham, Kent, makers of the well-known adhesive for bonding wood, phenolics, paper, leather, glass, etc., inform us that this adhesive is now marketed under the name "Titebond" and not as "Bondtite."

MR. T. J. FIELDING, O.B.E., A.M.I.E.E., formerly assistant marketing manager and technical editor, Bakelite, Ltd., has joined the board of Technical and General Advertising Agency, Ltd., 101, St. Martin's Lane, London, W.C.2, as a full-time director.

NOTES FROM BRITISH PLASTICS FEDERATION

Fabricators Group Luncheon

The Fabricators Group of the Federation held a luncheon at the Café Royal, London, on May 25, when Sir Graham Cunningham, chairman of the Production Committee of the Federation of British Industries, gave a talk on "Mutual Aid in Industry."

In the course of his talk he stated that mutual aid between manufacturers could materially assist in the improvement of productivity. He said that mere "works visits," whilst helpful, were not enough and that manufacturers should exchange prolonged visits between their experts, perhaps for a week or more. This exchange of visits should apply outside as well as within the industry.

Luncheon for Works Managers

The Moulders Group recently held a very successful informal luncheon meeting of works managers at the Waldorf Hotel, London. This was the first meeting of its kind arranged by the Group, although some sections have previously held local meetings.

Mr. L. G. Chaffey, chairman of the Group Technical Committee, presided, and the chairman of the Group, Mr. N. B. Punfield, was present to assist. The object of the meeting was to bring together works managers of member firms so that they might have an opportunity of discussing common problems.

Cast Aluminium Holloware

The Federation is represented on a Committee of the British Standards Institution concerning domestic cast aluminium holloware, with particular reference to use of plastics materials for the thermal insulation of handles.

Function Designs

The Council of Industrial Design has arranged a conference on Function Design to take place at the Royal Institute of British Architects, July 18 to 22. At the invitation of the Council of Industrial Design, the Federation has arranged for a speaker to give a short address on plastic materials in relation to functional design.

Moulding Powder Imports

The following quantities of moulding powder were imported on private account during February, March and April, 1949:—

	Feb. tons	Mar. tons	Apr. tons
Cellulose acetate-butyrate	152	115	26
Ethyl cellulose	—	1	—
Urea-formaldehyde ...	3	2	—
Polystyrene	255	439	581

P.I.G.S.—The third meeting of the Plastics Industry Golfing Society, 1949, was held at Wentworth Golf Club, Virginia Water, when over 50 members and visitors attended. A special prize of a leather grip, presented jointly by Messrs. P. Attwood, T. S. Crabtree and E. J. Lassen (all members of the Wentworth G.C.), was won by G. T. Armstrong, handicap 7, net 73, with J. T. Hyde as runner-up, handicap 16, net 73. Mr. Armstrong won on the best score over the last nine holes. The "Steuart" trophy was won by T. S. Crabtree, handicap 16, 38 points, Stableford bogey; the runners-up being H. E. Harden, handicap 8, and C. C. Last, handicap 14, 37 points each.

All golfers who are interested in the Plastics Industry N.W. Section, and the N.W. Section Moulders' Group of the British Plastics Federation, are invited to join the Plastics Industry Golfing Society, N.W. Section. Future outings are: August 17, Mere Golf and Country Club; September 29, Prestbury and Upton Golf Club. Further particulars may be obtained from the secretary, Mr. G. T. B. Sutherland, British Resin Products, Ltd., 2, The Downs, Altrincham, Chesire.

Low-temperature Polymerization

By W. S. Penn, B.Sc.

DURING the past few years a new technique has arisen in those industries based on high polymers, namely, the use of low temperatures in the polymerization of monomers to high-polymeric molecules.

The old idea to speed up a chemical reaction was to employ catalysts and to heat the reactants, or at least to increase the energy input by some means or other. In many instances this frequently did not produce the desired results, and it was believed for many years that some monomers could not be polymerized, or at least could only be made to produce dimers or trimers, etc. It has now been found that many of these, for example, α-methyl styrene and isobutylene, can be polymerized very effectively at low temperatures to form high molecular weight products.

The present article discusses the reasons for the use of these methods and describes the progress which has been made. Indications are also given of the future possibilities of the process.

Early Work

Without probably having the intention in mind, the earlier workers on polymerization gave a lead to the principle of low-temperature polymerization. It was hidden because their work involved showing the contrary, i.e., that the molecular weight decreases with increasing temperature of polymerization. This early work is very interesting.

Before polythene was produced commercially a great deal of work was carried out on the polymerization of ethylene. Various catalysts, temperatures, and pressures were employed, but very little success was obtained in the production of high molecular weight products. Some work which was carried out[1] showed that increasing the temperature of reaction from 400 degrees to 450 degrees C. produced more gases and lighter oils, and slight polymerization which previously resulted was reduced. Some similar work confirmed this,[2] as is shown by the figures in Table 1, for the production of higher olefins.

Again, in the polymerization of dimethyl butadiene[3] it was shown that, at 85 degrees C., a molecular weight of 3,520 was obtained, but at 145 degrees C. this was reduced to 2,140. A similar example may be given in the case of the polymerization of acetylene,[4] as shown in Table 2.

These examples, although not very important, do illustrate the principle involved and that it has existed for some considerable time. It can be best illustrated in the case of polystyrene.

Polystyrene

It was known for a long time that at 80 degrees C. styrene took an undesirably long period to polymerize to a useful degree of conversion of, say, 70-80 per cent. The temperature was, therefore, progressively increased to well over 100 degrees C., to speed up polymerization and to provide a satisfactory degree of conversion. It was, however, noticed that polymers produced by this method

Table 1.—Polymerization of Ethylene.

Temperature °C.	Higher Olefins per cent.
700	9.2
750	4.4
800	1.4
850	0.4

Table 2.—Polymerization of Acetylene.

Temperature °C.	Polymerization per cent.	Hydrogen per cent.
600	19	63.5
1,000	7.5	59.85
1,150	5	76.55

Table 3.—Polymerization of Styrene.

Temperature of Polymerization °C.	Average Length of Main Chain
20	2,600
60	2,000
100	1,200
132	550
220	350

Table 4.

Temperature °C.	Mol. Wt. Emulsion	Mol. Wt. Pure Styrene
30	750,000	600,000
60	400,000	350,000
	275,000	
100	175,000	120,000

were more brittle. Translated into terms of molecular weight, this means that at the higher temperatures the degree of polymerization was less. The enormous differences obtained may be observed in Table 3.[5]

This data, without any doubt, shows that high molecular weight products may be obtained at lower temperatures. A few more figures may be given for polystyrene, based on emulsion polymerization. The emulsions were prepared by shaking 20-50 per cent. of the monomer with a 5 per cent. sodium-oleate solution.[6] The results are given in Table 4.

These two sets of results admirably illustrate the principle involved. It is obvious that if the results given in Tables 3 and 4 were interpolated back to lower temperatures, much higher molecular weights would be obtained. That this has been confirmed in practice will be shown in the present article.

Theory of Method

It is interesting to inquire into the theory of low-temperature polymerization and the reasons why it is so important. Treating the last point first, the advantages to be derived from increasing molecular weight are well known. To name two, the tensile and impact strengths, are improved a great deal. This has been shown particularly in the case of the latest general-purpose synthetic rubber "Ultipara," produced at 41 degrees F. and having the same tensile properties as natural rubber. This new development will be described later.

To understand the reasons for a reduction in molecular weight on increasing polymerization temperature, it is necessary to split up the process of polymerization into its components. For a reaction to commence, we must have chain initiation. It does not matter, within limits, how rapid this part of the process is, because the process can be speeded up by this means without unduly affecting the length of chains (provided there is sufficient monomer present to satisfy each growing chain). Catalysts help to initiate this chain reaction, among which temperature is most important.

The second step in the process is chain propagation, and the time of this must be prolonged if a high polymer is to be produced. Temperatures and catalysts of many types seem to shorten this time, and consequently the chain length; it is for this reason that at higher temperatures we obtain shorter molecules. The kinetics of this reaction are discussed in detail by Mark and Raff.[7]

The obvious ideal would be to have rapid inception of active nuclei, followed by a long propagation period, and this is what we are trying to obtain in low-temperature polymerizations. Originally the use of low temperatures slowed down the reaction a great deal (chain initiation), although this did lengthen the time of propagation and consequently the chain length. However, catalysts are being developed which will speed up the rate of chain initiation at low temperatures, and this should be capable of yielding useful results.

Finally, it may be mentioned that, in addition to the advantage of increasing the molecular weight, the fact that previously unreactive molecules can now be made to polymerize is an advantage in itself. The process opens up an entirely new line of reasoning and practical work.

Isobutylene

One of the classical examples of the application of low-temperature polymerization is that of isobutylene. The application of this process to isobutylene and isoprene, or butadiene, has resulted in the production of butyl rubber, a very valuable synthetic rubber.

The fact that high polymeric molecules could be produced from isobutylene or butylene was not known for some time. In the case of the isomer, hot concentrated sulphuric acid results in the production of the open-chain dimer, 2-2-4 trimethyl pentene.[8] At high temperatures and pressures (180-250 degrees C. and 100 atmospheres) polymers are produced, but they are liquid and of low molecular weight.[9] Many catalysts were investigated, including lime, certain metals, magnesium, zinc and aluminium oxides, silica gel, and aluminium and boron chlorides.[10] There was not much success with these catalysts at elevated temperatures, although with the two chlorides it was found at ordinary temperatures that low molecular weight polymers (viscous liquids or sticky solids) could be formed.

The last fact is obviously suggestive; by reducing the temperature still further (−78 degrees C.), it was found that high molecular weight products could be formed.[11] At −10 degrees C. molecular weights of about 10,000 are produced; at −90 degrees C. those of about 220,000. The difference is most marked, although other factors, such as purity, etc., do enter into it. A liquid phase is employed with about 0.03 per cent. catalyst (boron, aluminium or similar fluorides). A yield of 90 per cent. can be obtained by this method.

One of the most remarkable features of this reaction is the rapid manner in which the polymer is formed. Normally with these low-temperature reactions the process is slowed down considerably. In the case of isobutylene, however, at its boiling point the reaction takes a long time and only an oil is produced. At −80 degrees, on the other hand, a high molecular weight product is formed in a fraction of a second. A very high-quality product and a high yield is obtained.

Butyl Rubber

The product formed by the low-temperature polymerization of isobutylene is a rubber-like material, which, nevertheless, has a great deal of cold flow. It was produced commercially by the I.G. as "Oppanol," and by the Standard Oil Co. as "Vistanex."

The Standard Oil Co. decided that it would be interesting, and probably valuable, to produce a material which could be vulcanized to eliminate this cold flow; therefore, they decided to copolymerize the isobutylene with an unsaturated monomer, such as butadiene or isoprene. As a result of this, butyl rubber was produced from about 96-98 per cent. isobutylene and 4-2 per cent. isoprene or butadiene.[12] The proportions have changed over the years according to various property requirements. The reaction was carried out at low temperatures (−78 degrees C. and lower), with the use of Friedel-Crafts catalysts.

The type of catalysts and method of application throughout the past few years has varied, but it has been usual to employ aluminium chloride dissolved in ethyl chloride.[13] Ethylene may be used as the liquid solvent and refrigerent. Once the low temperature is reached the catalyst is slowly injected into the mixture. The products formed may be vulcanized, with the aid of rubber-compounding ingredients, to give a rubber-like material with greatly reduced cold flow.

Classical Study of Methyl Styrene

It was for many years thought that either α-methyl styrene would not polymerize in the ordinary sense of the word or that it would only give low molecular weight products. Therefore it was deduced that a substituent in the side chain of styrene detracted from polymerization.

The evidence for this reasoning was outstanding. Catalytic polymerization

Table 5.—Polymerization of α-Methyl Styrene

Temperature °C	Molecular weight
100	5,600
110	2,600
125	1,100
150-155	370

Table 6.—Properties of Monomers

	S.G. (d_{4}^{20})	M.P. °C	B.P. °C	Refractive index n_D^{20}
Styrene	0.9056	−30.6	145.2	1.547
α-Methyl styrene	0.9134	−20	161-162	1.5384

with sulphuric acid gives only a dimer, diphenyl-dimethyl-cyclobutane.[14] The same applies at high temperatures,[15] and also in the presence of stannic chloride.[16] In the latter case, the polymerization takes place violently, but only low molecular weight products are formed. Even polymerization after prolonged standing at room temperature was of little use.[16]

The next step in the investigation was the study of the reaction at high pressures.[17] At 5,000 atmospheres and 100 degrees C., and in about 96 hours, 85 per cent. polymers with a molecular weight of 5,600 were obtained, and these materials were regarded as being high polymers! Increasing the pressure at any temperature did not increase the molecular weight, but only the yield. These efforts were obviously not yielding much success, but out of this work it was noticed that an increase in polymerization temperature reduced the molecular weight—this is shown in Table 5, based on polymerizations conducted at high pressures.

The effect is most marked and does indicate the possibilities of low-temperature polymerization for this material.

The final stage in the classical experiments on α-methyl styrene was efforts at copolymerization. Apparently, the fact that the methyl styrene will not readily polymerize by itself under heat does not detract from the possibility of it copolymerizing with other molecules by this process; α-methyl-p-methyl styrene will copolymerize with styrene[18] and acrylonitrile[19], and copolymers of -α methyl styrene with maleic anhydride[20] and butadiene[21] have been reported. This means that the possibilities of polymerization are not completely extinct.

Recent Work on α-Methyl Styrene

The work on the low-temperature polymerization of isobutylene-diene systems prompted certain investigators[22] to try out the method on α-methyl styrene. This was important, because this monomer could be readily stored at room temperatures, whilst special precautions had to be taken in the case of styrene to prevent polymerization. It was a possibility, for instance, that in the plastics and synthetic rubber industries the styrene might be replaced by α-methyl styrene, particularly since a low-cost source of the latter was available[22]. The properties of the two compounds are given in Table 6.

Before describing the methods in detail, it may be recorded that very high molecular weight products have been obtained by this technique. Values of 84,000 using Kemp Peter's K constant[23], for styrene, and about 252,000 using

Table 7.—Polymerization of α-Methyl Styrene

Dilution ratio (solvent/monomer)	Reaction temperature °C.	Conversion %	ntrinsic viscosity	Molecular weight	Catalyst solution (aluminium chloride in ethyl chloride) per cent.
14/1	−130	86	2.56	58,900	1
6/1	−100	—	0.68	15,600	1
2/1	−77	—	0.50	11,500	0.5
1/1	−50	73	0.19	4,400	1
14/1	−20	—	0.036	840	1
1/1	−19	—	0.093	2,140	1
1/1	0	—	0.098	2,260	0.5

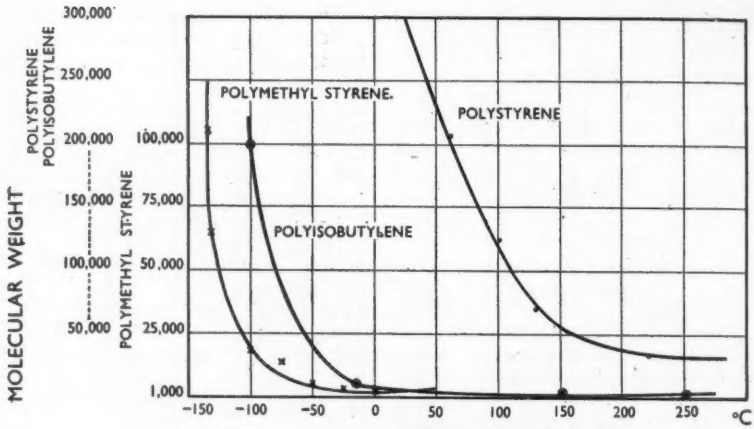


Fig. 1.—Low temperature polymerization curves.

Staudinger's K constant[24], have been obtained (using formula M.W.$\doteq[\eta]$K). These results show the extreme value of the method.

The experiments were carried out with ethyl chloride as a diluent, and this could also act as a solvent for aluminium chloride, which was employed as the catalyst. The spray method of catalyst addition was employed[25,26]. In the experiment, a mixture of the monomer and diluent is charged into the reactor, which is provided with an efficient agitator. The mixture is then cooled to −78 degrees C. by means of powdered solid carbon dioxide, and a previously cooled solution of the catalyst is injected through a glass orifice (0.012-in. diameter) by pressure.

After the reaction, cooled ethyl alcohol is added as a stopping agent, and the polymer is then isolated by means of evaporation of solvent and steam distillation. It should be noted that the monomer freezes at −23 degrees C. and therefore very dilute solutions have to be employed so that experiments can be carried out below this temperature.

Table 7[22] gives some of the results, which were obtained from a series of experiments carried out in the above manner.

The effect of dilution and temperature can be readily seen from Table 7. The effect of reduction of temperature can be better seen from Fig. 1, and at the lower temperatures the rapid increase in molecular weight is most pronounced. Once again, in this particular case, the reaction is almost instantaneous and a high degree of conversion is obtained in a matter of seconds. This is one of the problems, since the reaction is exothermic and any local build-up of heat causes an immediate and rapid reduction in molecular weight. It will be seen from the curve that an increase of a few degrees will cause a reduction of tens of thousands in the molecular weight. Rapid agitation is therefore necessary for the dissipation of heat, and more aspects of this are given later in this article.

As far as the properties of the polymers are concerned, the low molecular weight types are very brittle. Those of higher molecular weight are quite tough, but more brittle than a polystyrene of equivalent molecular weight. On the other hand, the softening point of the polyisomer is about 100 degrees C. higher than that of polystyrene of the same molecular weight, which is a very important feature.

Copolymers of Methyl Styrene

Normal copolymers of methyl styrene may be obtained with butadiene and maleic anhydride by heating at elevated temperatures (about 100 degrees C.), but with isobutylene it is necessary to employ the low-temperature technique.

In the case of such copolymers, a temperature of −105 degrees C. is employed with the same technique and catalysts as with the straight methyl styrene. Various compounds were made, ranging from those containing 60 per cent. isobutylene and 40 per cent. methyl styrene, to those containing 85 per cent./15 per cent. mixtures. The former are stiff, board-like products; the latter, rubber-like. Those polymers containing the high proportion of methyl styrene only had low molecular weights, and there appeared to be some mutual inhibitory effects between the two monomers.

Catalysts

A few words may be said regarding the type of catalysts which are employed in these experiments. These are the metallic halides, and they may be responsible for a peculiar chain initiation and propagation mechanism. The catalysts possess a metal atom with some $\delta+$ character, this being because the metal-halogen bond is more or less polarized. The halide itself takes part in the polymerization,[27] and not the acid (formed with water). Such a complex as the polymerization nucleus is formed if the strength of the $\delta+$ character of the metal atom is sufficient. Formation also depends on the degree of steric hindrance which is caused by the halogen atoms, and also on the polarizability of the free electron pair of the double bond. In isobutylene the free electron pair is polarized to a certain degree. This will then quite easily be fixed by boron trifluoride or aluminium fluoride, which will cause polymerization.

Synthetic Rubbers

The supreme achievement to date of the use of low-temperature techniques is in the manufacture of synthetic rubbers. The type referred to is the butadiene/styrene copolymers, containing approximately 75 per cent. and 25 per cent. of the two components respectively.

The synthetic rubber industry is a huge one and nearly a million tons capacity per annum of GR-S (as this copolymer is called) was attained during the war. The standard method was emulsion polymerization at 122 degrees F., with the use of a persulphate catalyst, a fatty acid emulsifier, and a dodecyl mercaptan modifier. A detailed account of this standard procedure has been given.[28]

After this industry got under way it was realized that GR-S, as then produced, was not satisfactory. The main trouble was in tyre treads, where extensive cracking took place; extensive research was undertaken to find methods of overcoming this and similar troubles. Several lines of reasoning and experiment were undertaken; of these, low-temperature polymerization has been the most successful.

Development of Process

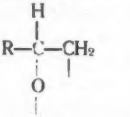
Even in 1941 it had been suggested that better general-purpose synthetic rubbers would be obtained by lowering the temperature of polymerization.[29] The temperature suggested was 35 degrees C., and large-scale tests were carried out in 1943, using a temperature of 104 degrees F.

These lower temperatures did yield better rubbers, but there was one notable disadvantage. As the temperature was lowered, so the time of polymerization to a reasonable conversion was increased. At 122 degrees F. it was 14 hours; at 104 degrees F., 30 hours; and at 86 degrees F., 70 hours was required—which obviously made the process impracticable on a large scale. Methods were therefore sought for speeding-up the reaction, and it was found[30] that an increase in soap (emulsifier) concentration speeded-up the polymerization.

Various other ingredients of the mix were varied in the same manner, but the most important advance was in the

catalyst. This resulted in the important development of the "redox" catalysts employing both oxidation and reduction.[31, 33, 34, 35] Various systems of this type have been tried, but the use of cumene hydroperoxide[32] has been found very useful and has been adopted in practice. This resulted in the time being brought back to what it was originally.

The redox system is so important that a description of the theory of the method would not be out of place. It is a fairly common view in Germany[33] that oxygen and oxygen-bearing compounds play the rôle of converting vinyl compounds (and synthetic rubbers may be regarded as falling in this category for the purpose of redox polymerization) into the active oxidized form:



This is what causes the polymerization. Unfortunately, however, excess oxygen produces a moloxide

which is not active in initiating chains. It has been found that sodium hyposulphite ($Na_2S_2O_4$) will overcome this difficulty by reducing the moloxide back to the active form. It is also necessary to have a small amount of metal present which can change its valency.

In the redox system, either the oxidizing or reducing agent should be water-soluble; one agent should also be hydrocarbon soluble. In a typical example, potassium persulphate is the water-soluble oxidizing agent; perbenzoic acid is the water-insoluble oxidizing agent; and dihydroxy acetone or glucose is the water-soluble reducing agent. It is extremely important to control pH. A great deal of work has been carried out on all aspects of the subject in England.[34, 35]

The various changes which were made are summarized in Table 8.

To indicate the type of procedure adopted in low-temperature polymerizations a typical plant procedure for a low-temperature synthetic rubber will be described.

Table 8.—Polymerization Conditions

Ingredient	Original GR-S	Present GR-S	Copolymer 41°F.
Butadiene ..	75	71	71
Styrene	25	29	29
Oxidizing agent:			
Potassium persulphate ($K_2S_2O_8$) ..	0.30	0.23	—
Cumene hydroperoxide ..	—	—	0.15
Activator:			
Dextrose ..	—	—	2.5
$FeSO_4.7H_2O$ ..	—	—	0.1
Sodium pyrophosphate ($Na_4P_2O_7$) ..	—	—	0.6
Emulsifier (in p.p.m.):			
Fatty acid 90% solution	4.6	4.3	—
"Dresinate 731"	—	—	4.7
Modifier:			
Dodecyl mercaptan ..	0.6	0.45	—
Tertiary C_{12} mercaptan ..	—	—	0.2
Reaction temp., °F.	122-130	122	41
Conversion % ..	77	72	60
Reaction time, hours	15-17	13-15	20-22
Final ratio of butadiene/styrene	79.21/20.79	76.5/23.5	76.5/23.5

Plant Practice

In standard GR-S plants, sequence of operations comprises storage, pigment preparation, reaction, recovery, coagulation and finishing.[36] So far as monomer handling and storage is concerned, nothing very different is required where low-temperature polymerization is involved. The polymerization inhibitor p-tert-butyl catechol is removed from the butadiene in the normal manner. The same applies to the "pigment area," which is merely where the emulsifier, activator, short stop and antioxidant emulsions or solutions are prepared.

The jacketed reactors employed are lined with glass and cooled through the medium of a coolant (50 per cent. isopropanol/water) with ammonia. The reactants are continually agitated with blades revolving up to 300 r.p.m.

All the raw materials (except catalyst

and modifier) are passed through a feed-stock cooler before charging into the reactor. The monomers, emulsifier, five-eighths of the water, and the activator are more or less charged into the reactor at the same time. Last of all is added the catalyst, with the remainder of the water, to ensure that polymerization will not start before 41 degrees F. has been reached. At the end of the reaction (after 22 hours) a "short-stopping" agent is added to stop polymerization. Furfural is quite important here. Finally, an antioxidant is added to prevent oxidation during the drying processes. The latex thus produced is creamed with brine and coagulated with sulphuric acid. It may be noted that low-temperature latex is less stable than that produced by normal methods and great care has to be taken in handling it.

Properties of Product

It is interesting to compare the properties of the rubbers produced at the various temperatures. The first important property where a change has been effected is processability. With the old-type GR-S, it took much longer to break the polymer down as compared with natural rubber and the fillers could not be incorporated as readily. The crude low-temperature polymer can be stretched slowly into almost endless filaments. This indicates polymolecularity, and the polymer breaks down as rapidly on the mill as natural rubber. In addition, fillers can be incorporated much more rapidly. These properties, it should be noted, are in spite of the fact that the chain length of the molecules has increased, and this aspect is discussed in the next section.

Table 9.—Properties of Low Temperature Rubber

	Standard GR-S	Low temperature GR-S
Tensile strength, lb./sq. in. ..	2,875	4,100
Viscosity (Mooney)	51	64
Elongation %	590	690
Modulus 300 %	960	960
Flex life (De Mattia)	35.0	49.6
Resilience %	16.0	44.0

As far as the physical properties are concerned, quite extensive improvements have been made. The tensile strength has been increased by about 1,000 lb./sq. in. Table 9 gives the results of some tests on two typical stocks compounded in a way to produce optimum properties.

It will be seen from Table 9 that the properties of the low-temperature synthetic rubbers are quite good, and they are more or less as good as those of natural rubber itself (when compounded with carbon black). In addition to this, the abrasion resistance, flex-cracking and cut-growth are improved a great deal.

These advances are undoubtedly good, but it should be noted that the rubbers still have certain defects as compared with natural rubber. The tensile strengths of the gum stocks are much lower, the hysteresis or heat build-up is greater and the tackiness of the new stock is not so great. There is still a long way to go, but a big step has been taken in the right direction.

Structure of Polymers

It would be interesting to inquire into the changes in the GR-S polymers on changing the temperature of polymerization. Before doing this, however, it is necessary to mention the principal differences between natural rubber and ordinary GR-S.

Natural rubber is essentially a straight chain polymer, although there is a certain amount of branching, but no cross-linking. The isoprene units are combined principally in the 1,4-position and the polymer is the cis-isomer. All this is evidenced by the crystallinity of natural rubber, as shown by X-ray analysis.

In the case of GR-S, however, the structure is far more heterogeneous. There is quite a substantial amount of branching and cross-linking of chains. Secondly, there is a large proportion of the trans-isomer present and, in any case, the molecules are linked in both the 1,2- and 1,4-positions.

There is some evidence to show that as the temperature of polymerization is reduced, the structure of the GR-S becomes more regular.[37] There is a slight increase in the proportion of 1,4 addition, and simultaneously there is an increase in the amount of trans-isomer present. At 0 degrees F. the polymer is almost entirely free of the cis-isomer, and in this respect is something like gutta percha, the trans-isomer of polyisoprene. All this is evident from a tendency of the polymers to crystallize, which is shown by very faint X-ray diagrams. These are not obtained (or only so with extreme difficulty) from high-temperature polymers. It is also probable that there is an increase in molecular weight since the tensile strengths of the compounded stocks are substantially improved. Much of the increase, however, is probably due to the increased regularity of the polymers.

Emulsion Polymerization

There are many problems associated with low-temperature polymerization. One of the most important problems is associated with heat-transfer considerations. The build-up of heat must be prevented at all costs at any point in the system. As already shown, and as to be considered further, a rise in temperature of a few degrees will cause a tremendous lowering in molecular weight with a resultant loss of properties. The problem of heat transfer has been considered in great detail by J. E. Troyan[38] and reference should be made to the original literature for details of this complex subject.

Also associated with low-temperature polymerization is the problem of emulsion polymerization. In the case of synthetic rubbers, where temperatures range only from 0 degree to 35 degrees F., this is not so great and special "antifreezes" can be employed to prevent the water from freezing. Methanol is quite good and may be readily recovered.[38]

In the case of such materials as butyl rubber and α-methyl styrene, the use of antifreeze materials is not possible (at −70 degrees C. or more), and it has been necessary to use solutions of the monomers. This method of polymerization is much slower than the emulsion technique, and it is not surprising that methods of overcoming the trouble have been looked for. A possible answer to the problem has been found by Bachman and others.[39]

The use of water has obviously had to be discontinued and the problem was to find a medium in which isobutylene was not soluble or with which aluminium chloride did not react. Such liquids have only recently been found in the form of fluorocarbons. Those which have been tried include perfluoro-m-xylene and a 1 : 3 mixture of perfluoromethyl naphthalene and perfluoromethyl cyclohexane. These two solvents remain liquid between the range −95 degrees C. and +80 degrees C., which is extremely useful. They have the necessary properties mentioned above, although no suitable dispersing agent could be found. The emulsion was made by rapid stirring, which had to be maintained throughout the reaction. The method has proved quite effective in the control of polymerization.

Conclusions

There are many conclusions which can be drawn from the considerations which have been made on low-temperature polymerization. The discussion is best commenced with reference to Fig. 1, which shows three curves for styrene, α-methyl styrene, and isobutylene, plotting molecular weight against temperature. Although the scale of molecular weight is not the same in all cases, this is not important as it is merely wished to compare the shape of the curves.

A comparison of the three curves readily indicates that they all have the same general shape. There is in every instance a large flat curve following the temperature axis, followed by a rapid change of direction, to finish with a curve following the molecular weight axis. It seems that the same type of reaction

takes place in all instances. This consists in the first instance of a normal-type slow polymerization, followed by the ionic-type rapid polymerization. In the former case, a drop of some 200 degrees C. in the higher ranges of temperature only makes a difference of a few hundreds to the molecular weight. Below a certain point, however, a drop of only a few degrees can cause the molecular weight to increase by many thousands.

It is obvious from these considerations that there are two distinct types of polymerization, one before a certain point and one after. We may call this the "polymerization transition point." It differs in the case of the different monomers, and it is important because, to obtain really high molecular weight polymers, the reaction must be carried out below this point. The obvious inference from this is that the point must exist for other monomers, previously unrealized.

This subject opens up many possibilities for improving plastics. In the case of the acrylates, styrene and similar materials, it might be possible to obtain very high molecular weight plastics by these same low-temperature techniques. Undoubtedly a great deal of work will be carried out along these lines in the future. It might also be possible to improve impact and tensile strengths to values undreamed of, although the processing problems might be great.

REFERENCES

(1) *K. Smolenski and S. Kowalewski,* "*Bull. Acad.Pol.,*" *(A),* 1934/315. **(2)** *E. N. Hague and R. V. Wheeler,* "*J.Chem.Soc.,*" 1929/390 **(3)** *G. S. Whitby and R. Crozier,* "*Can.J.Research,*" 1932/**6**/203. **(4)** *W. A. Bone and H. F. Coward,* "*J.Chem.Soc.,*" 1908/**93**/1197. **(5)** *G. V. Schulz,* "*Z.physik.Chem.,*" 1939/*B.***43**/25. **(6)** *H. Staudinger and E. Husemann,* "*Ber.,*" 1935/**68**/1691. **(7)** *H. Mark and R. Raff,* "*High Polymeric Reactions,*" 1941 *(Interscience Publishers, Inc.)* p.155 *et seq.* **(8)** *Brit. Pat.* 522,818. **(9)** *Fr. Pat.* 853,642.

(10) *V. N. Ipatieff and B. B. Corson,* "*Ind.Eng. Chem.,*" 1935/**27**/1069. **(11)** *R. M. Thomas, W. J. Sparks and P. K. Frolich,* "*J.Am.Chem.Soc.,*" 1940/**62**/276. **(12)** *Brit. Pat.* 413,521 (1939). **(13)** *Brit. Pat.* 523,228 (1940). **(14)** *M. Tiffeneau,* "*Ann.chim.,*" 1907/**10**(8)/158. **(15)** *S. V. Lebedev and E. P. Filonenko,* "*Ber.,*" 1925/**58**/163. **(16)** *H. Staudinger and F. Breusch,* "*Ber.,*" 1929/**62**/442. **(17)** *R. H. Sapiro, R. P. Linstead and D. M. Newitt,* "*J.Chem.Soc.,*" 1937/1784. **(18)** *R. C. Palmer,* "*Ind.Eng.Chem.,*" 1942/**34**/1028. **(19)** *E. L. Kropa, U.S. Pat.* 2,310,961 (1943).

(20) *Brit. Pat.* 276,479 (1932). **(21)** *E. Tschunker and W. Bock, U.S. Pat.* 1,938,730 *and* 1,938,731 (1933). **(22)** *A. B. Hersberger, J. C. Reid and R. G. Heiligmann,* "*Ind.Eng.Chem.,*" 1945/**37**/1073. **(23)** *A. R. Kemp and H. Peters,* "*Ind.Eng.Chem.,*" 1942/**34**/1097. **(24)** *H. Staudinger,* "*Trans.Faraday Soc.,*" 1936/**32**/97. **(25)** *R. M. Thomas and I. E. Lighbourn, U.S Pat.* 2,276,893 (1942). **(26)** *R. M. Thomas and O. C. Slotterbeck, U.S. Pat.* 2,243,658 (1941). **(27)** *J. P. W. Hartman,* "*J.S.C.I.,*" 1947/**66**/102. **(28)** *V. A. Cosler and W. S. McCune,* "*India Rubber World,*" 1948/**117**/481. **(29)** *W. H. Shearon, J. P. Mckenzie and M. E. Samuels,* "*Ind.Eng.Chem.,*" 1948/**40**/769.

(30) *R. R. Dunbrook,* "*India Rubber World,*" 1947/**117**/203. **(31)** *C. F. Fryling, U.S. Pat.* 2,379,431 (1945); 2,383,055 (1945). **(32)** *E. J. Vandenberg and G. E. Hulse,* "*Ind.Eng.Chem.,*" 1948/**40**/932. **(33)** *F.I.A.T. Final Report* 618 (1945). **(34)** *J. H. Baxendale, M. G. Evans, and others,* "*Trans. Faraday Soc.,*" 1946/**42**/155. **(35)** *W. H. Stockmayer,* "*J.Chem.Phys.,*" 1944/**12**/125. **(36)** *F. J. Soday.* "*Trans.Am.Inst.Chem.Eng.,*" 1946/**42**/647. **(37)** *W. F. Tuly,* "*Rubber Age*" *(N.Y.),* 1948/**64**/193. **(38)** *J. E. Troyan,* "*Rubber Age*" *(N.Y.),* 1948/**63**/585. **(39)** *G. B. Bachman, H. B. Bass and E. J. Kahler,* "*Ind.Eng.Chem.,*" 1949/**41**/135.

GERMAN PATENTS.—Microfilm reproductions of approximately 146,000 unpublished applications for patents filed by enemy nationals in the German Patent Office and found to be intact at the end of the war, were placed open to public inspection at the Patent Office, London, on November 1, 1948. The microfilms are contained on 1,018 reels and a microfilm reader has been temporarily installed for public search purposes.

MONSANTO CHEMICALS, LTD.—Mr. N. F. Patterson, previously works manager at the Ruabon plant, is to be general manager of production, responsible for all manufacturing and plant development operations, as from July 1. His base of operations will be Ruabon. The new works manager at Ruabon will be Dr. W. A. Hayward, formerly production manager at Ruabon.

The Microscopic Examination of Plastic Materials

VII.—Mouldings (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

WHEN examining the structural details of the moulding produced in 1922 from a multiple part powder, it will have been noticed that the fillers used in those days were sieved to a wider tolerance of mesh sizes than is in general use to-day. This is indicated by the number of different-sized particles to be encountered throughout the structure and the presence of an appreciable fraction of fine dust, constituting part of the matrix.

Nevertheless, the strength of the moulding was comparable with that of present-day materials. At first sight this might appear to offer a measure of contradiction to the previously developed theories regarding the effect of extraneous dust on the strength of a moulding, but it must be remembered that in the material under discussion the relationship existing between filler and resin so closely approaches the ideal concept of perfect impregnation that it is possible that much of the effect to the wide-range filler is offset to some extent.

The question therefore arises as to the reason for the difference in structure so far encountered between this old moulding and the modern material dealt with immediately prior to it. In the latter, although a two-part powder was used, it was clearly seen that impregnation of the wood particles was far from complete, but in spite of this was considered to be fairly good until the older material was examined. In the same way, the pigmentation in the new material showed a much inferior distribution to that used in the old. There are several reasons whereby these differences may be explained, thus it is probable that a higher percentage of resin was used in the old moulding as, at that time, there was no drastic shortage of phenol such as has existed during the past few years. This latter contingency has been met partly by a cutting-down of the resin content in moulding powders, which adds to the difficulty of achieving the desired result.

The difference in pigment distribution is probably due to the nature of the material used, as the modern material employed iron oxide and the older material used fine carbon black. This, when taken into consideration with differences in resin content, would in some measure account for the conditions noticed, as the presumably higher resin content of the older material would tend to facilitate mixing and distribution of the pigment during the manufacture of the moulding powder. However, it is doubtful whether the difference in resin content between the two materials amounts to much more than 10 per cent., which would not account for the big difference in pigmentation and impregnation.

Unfortunately, very little information is available concerning the old moulding, but as a rule resin viscosities were lower and curing times somewhat longer at that period, which could account for a large part of the difference. Bearing in mind, however, that in spite of this there is very little difference in the strengths of the two materials, it seems logical to suggest that if modern methods could be adopted to produce structures similar to the older material, then the strength of present-day materials could be improved without

Fig. 399.—Section of one-part wood-filled phenolic moulding. Mag. 26 diameters.

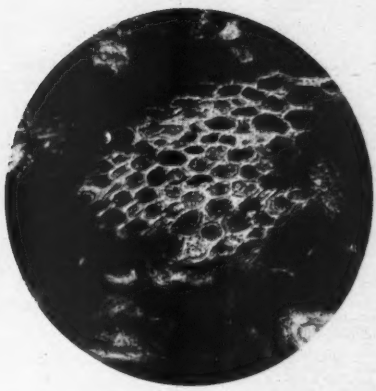


Fig. 400.—One-part wood-filled moulding showing particle in transverse section. Mag. 96 diameters.

sacrificing the saving in resin content which is achieved.

In view of this it is expedient to examine a modern material of standard characteristics as used for ordinary electrical mouldings. The material to be discussed is a single-part, black, wood flour filled powder, producing mouldings in conformity with B.S.S.771, and may be taken as being representative of this type of material.

The specimen consisted of a standard moisture-absorption disc, of which a transverse section was taken at the middle of the disc. A general view of the structure of this material (Fig. 399) illustrates the effect produced by a more modern wood flour sieved to somewhat closer tolerances. The filler used in this material is the conventional 80-100-mesh softwood flour and includes a small percentage of "fines," which can be seen to form part of the matrix material surrounding the larger wood particles, examples of which are illustrated at A. It is of interest to note that these flour elements are of their type and do not show a great deal of evidence of having been distorted during moulding. The upper one of the three particles shown exhibits definite signs of resin having penetrated its structure, but at this magnification one cannot be certain of this.

The general configuration of the structure is of interest, inasmuch as very few signs of orientation having taken place are noticeable; actually this is not unexpected when the position of the section and the nature of the moulding are taken into consideration. At the centre of the disc the majority of flow would occur near the top and bottom faces of the specimen, having a comparatively undisturbed area midway between, and as the section is taken in the centre of the disc and the field illustrated is approximately midway between the faces, the comparative lack of orientation in this structure is more or less explained. Certain of the particles, however, are of interest and warrant closer examination, such a one being the particle marked B, indicating the presence of a unit in transverse section.

This particle, as seen in Fig. 399, shows signs of being well filled with resin; it is somewhat different when higher magnification is used, for in Fig. 400 it is clearly noticeable that some of the vessels are filled, while others appear to contain something different from the pigmented resin which, of course, appears black. This appearance is interesting enough to

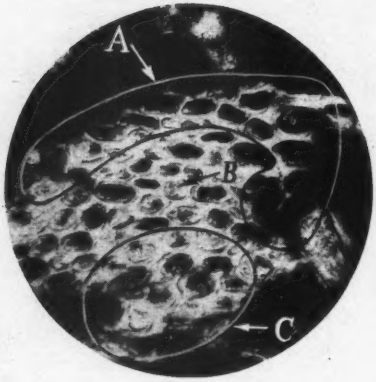


Fig. 401.—Section of one-part wood filled moulding. Mag. 200 diameters.

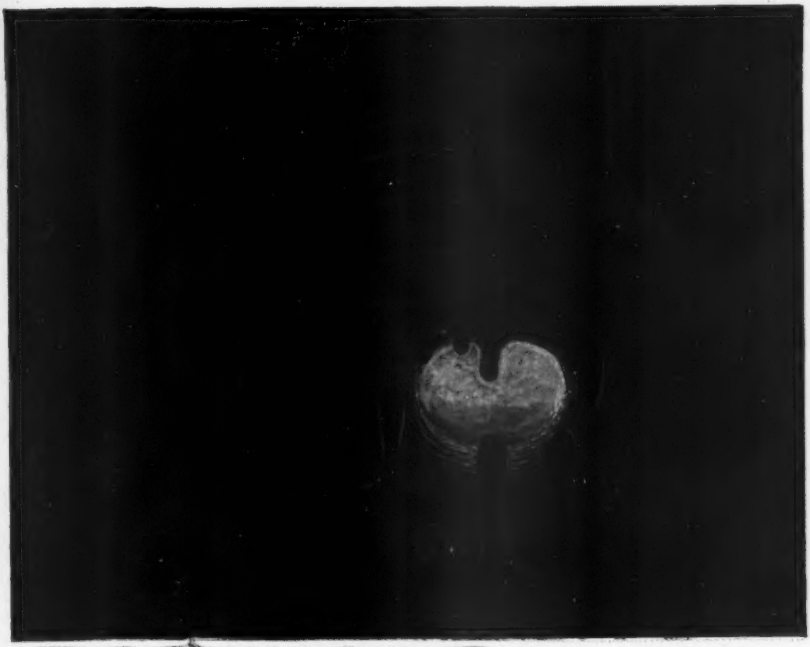
Fig. 402.—Section of one-part wood filled moulding. Mag. 370 diameters.

call for further investigation; however, for the time being it seems to suggest that in those cases where the vessels are filled with the black opaque substance they contain resin and pigment, while the other vessels might be filled either with resin which has been subjected to an appreciable degree of filtration or they are filled with the remains of their natural contents.

In the former case the filtration would, if it occurred, be due to constriction at the ends of the bore, or it may be brought about as a result of the ends of the vessels being completely sealed, thus leaving the wall pits as the only means of communication from cell to cell. It has been previously demonstrated that these pits serve this purpose during life and become sealed in the mature wood. Therefore, it will be appreciated that this is no criterion of the condition of the wood, that is to say, whether it is heart wood or sap wood, as in the case of the former the moulding pressure would be capable of unsealing the pits and in the latter case the way would be open. This point is raised in order to avoid misinterpreting the facts which could suggest that the particle is sap wood, always assuming that the vessels in question are filled with resin and/or their natural contents.

In general, the particle is seen to have suffered little damage due to collapse. The structure being very open and typical of softwoods, the only indication that a slight degree of collapse may be present is in the roundness of the vessels, which under natural conditions are somewhat more square. However, in spite of the walls being thin, the lumens are quite open; thus we are led to the fact that the rounding-off of the corners is just what might be expected of such a structure when filled with a fluid medium and which also surrounds it, and the whole being subjected to a hydrostatic pressure.

The structure is made a little more clear in Fig. 401. It is now possible to see in some detail the tendency for the heavily pigmented resin to fill the more peripheral vessels in the structure, as indicated by those in the area marked B. There are, however, a number of vessels more or less filled by the dense material situated at the centre of the particle, but in the majority of cases it will be seen that they are not filled to the same extent as the peripheral members, as indicated by the density of the contents. On the other hand, the central vessel B indicates a filling of almost pure resin due to the appearance of what appear to be a few pigment granules and as the presence of the one presupposes that of the other, the assumption of the presence of the latter



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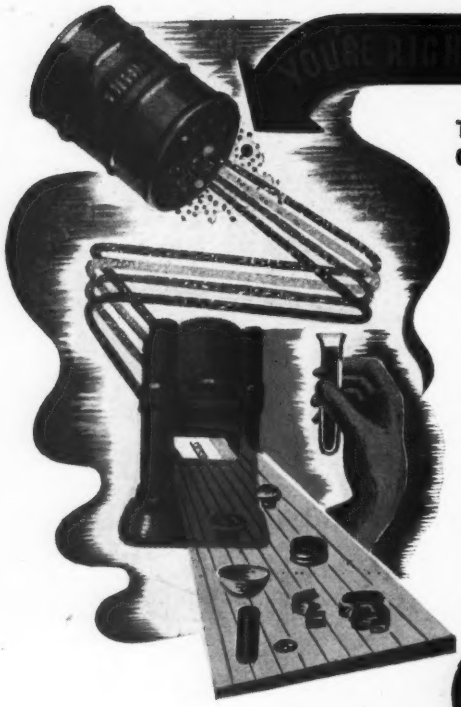

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is logical. This being so, considerable filtering of the matrix must have occurred to bring about filling of this nature.

There still remains a doubt, however, as to whether the structure seen indicates the presence of tissue pigment particles and only recourse to higher magnifications is able to throw any light on the problem. On subjecting area C to a magnification of 370 diameters, as shown in Fig. 402, it becomes apparent that the majority of the vessels contain some pigment granules. It is fortunate that there exists a means of comparison in the form of the less than usually dense resin mass outside the particle and shown by the area A, wherein the pigment distribution has been disturbed by some external cause—not immediately concerned with the problem in hand—which makes visible the general appearance of the pigment granules in this material. These are seen in that portion of area A which is marked off with the dotted line.

If we examine the group of six vessels contained in area B, slightly above A, and more towards the periphery of the particle, these are clearly seen to contain —in each case—a number of similar pigment granules, thereby stabilizing the presence of resin in the lumens. Immediately above area B are a number of vessels which do not exhibit the presence of pigment granules, but nevertheless give the impression of being filled with something, due to indications of a structure of sorts present in the lumens, which must undoubtedly be filled as otherwise they would have collapsed. The identification of this filling cannot be based on the presence of pigment granules, as there is none present.

It therefore becomes expedient to find some other evidence which might lead to its identification. This can be obtained by examination at still higher magnifications, which reveals the presence of almost pure resin by showing the existence of the now familiar bubbles of minute size and in large numbers, the typical yellow colour of clear resin in thin sections being unmistakable.

Having obtained this information relating to a particle of filler as seen in transverse section, it is now proposed to examine a unit presenting an aspect in longitudinal section. We have seen that there exists strong evidence pointing to constriction of the wood vessels at the ends of the particle, as being one explanation of the considerable degree of filtration encountered. Thus the immediate problem becomes one of endeavouring to ascertain the nature of the constriction and the causes.

Fig. 403.—One-part wood filled moulding showing particle in longitudinal section. Mag. 96 diameters.

One possible cause for constriction occurring lies in the presence of tracheid ends. From the morphology of softwoods it has already been shown that the woody material is composed of relatively short tracheids possessing end walls which do not degenerate, as a rule. This feature, together with the absence of large continuous vessels, serves to distinguish this type of wood from the hardwoods. In view of this, and the length of the particles of softwood flour in this moulding, there is a distinct possibility of the occurrence of intact end walls in the structure of such units.

In Fig. 403 the magnification is sufficient to show clearly the individual tracheids in longitudinal section. Three of these individuals are seen very clearly at A, B, and C; the one marked A is seen

Fig. 404.—Section of one-part wood filled moulding. Mag. 370 diameters.

to possess a fairly large lumen which has become filled with resin and pigment granules. It is of interest to note, however, that due to the lumen tapering towards the upper end of the particle, the pigment granules become less numerous in this direction, but as to whether the taper is due to the proximity of an end wall, or mechanical collapse due to pressure, is a matter for conjecture.

A good example of an end wall and its effect is seen to exist between cells B and C, where the dividing wall is clearly shown at D. This particular flour particle is not as long as those usually found in this material, and as this dividing wall is situated at about the centre of the particle the ends of the two tracheids B and C present the full aperture of the lumen. In consequence of this the units are almost completely filled up to the dividing wall in each case. The unit marked C, however, has produced some filtering due to the partial collapse of the vessel at a point near the indicating arrowhead.

At the same time there will be seen several constrictions of tracheid ends within the area E which are worthy of closer examination, as shown in Fig. 404. From this illustration it is clear that three very definite constrictions exist at A, B, and C, with a possible fourth at D. In view of the presence of resin and pigment granules in the lumens beyond these constrictions, it is apparent that they must have occurred at some time after the resin had become liquid, and an initial quantity had entered the bores. The constrictions themselves being developed by a partial collapse of the end structure of the particle.

From Fig. 403 it will be seen that the tracheids under examination are unrestricted throughout the length of the particle, the upper ends of this vessel being open. The exception is in the tracheid with the constriction marked B (Fig. 404), which tapers down to an end wall at the farther end of the particle, with the net result that filtration of the pigment has occurred. From this it would seem, as may be expected, that liquefaction of the resin occurred at the lower end of the particle, at first resulting in the establishment of a pressure gradient above it. Thus the lower ends of the tracheids would admit a certain amount of resin and pigment until the point was reached where the building-up of the pressure was too much for the cell walls and the ends collapsed, preventing further entry of the resin. Meanwhile, liquefaction outside is proceeding as the pressure is rising, so that a lower pressure exists in the structure of the wood, which probably resulted in a small degree of general collapse on to the resin already present in the lumens. This would tend to distribute the resin evenly throughout the structure and level off the internal pressure until the entry of liquid resin at the upper end of the particle balanced the internal and external pressure.

Mention has previously been made of the presence of natural cell contents in cases where the wood particles come from sap wood. As it is impossible to produce a sharp segregation of the two grades, one must inevitably expect to find examples of sap wood, particularly in these times of accelerated ageing and maturing of commercial timber stocks. It is therefore of some interest to examine

Fig. 405.—One-part moulding showing particle of resinous wood. Mag. 370 diameters.

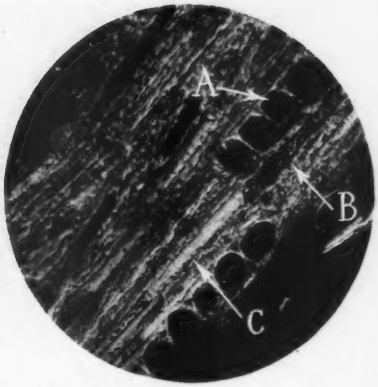

Fig. 406.—One-part moulding showing particle possessing medullary ray material. Mag. 370 diameters.

any examples of particles of immature wood when discovered.

One tendency of the soft woods is the production of resin ducts running in the same direction as the medullary rays, and whereas the majority of white woods are very nearly resin-free, other species exist having a relatively high resin content, for which reason a low maximum resin content is usually specified for wood flours used for moulding powders. Nevertheless, it becomes of some importance to be able to identify resin ducts, in order that any undesirable consequences may be avoided. The appearance of these structures is characteristic, and, provided that they have not been obliterated by morphological distortion during processing, they can be readily identified.

Fig. 405 shows a particle in longitudinal section, with a resin duct in situ at A. This duct is quite undamaged and exhibits its characteristic appearance as seen in a wood section. The member is complete with its contents, which do not seem to have suffered to any great extent. The feature of greatest interest, however, is the manner in which its presence is responsible for the production of completely sealed end walls in the two tracheids on either side, resulting in a considerable degree of filtration of their contents.

In general, these resin canals occur in the centre of a medullary ray, as seen in transverse section and are usually seen as isolated units in the so-called resin-free white woods. The contents of the example shown are in all probability the soft cells lining the duct.

These resin canals are, however, no sure indication of the presence of immature wood, as they also occur in fully matured specimens. The best pointer to the presence of the former is the existence of particles showing evidence of medullary ray structure, as seen in Fig. 406, which illustrates a portion of a large wood particle in the moulding whose structure includes part of a medullary ray. The cells of this ray are filled with their natural cell contents, and not resin and pigment, as might at first sight be thought to be the case. If the medullary cells A are examined and their contents compared with that of the tracheid B, below and to the right, the differences in the structure of the contents of the two types of cell become apparent, for it will be noticed that the tracheid is filled with the typical resin/pigment mixture, which

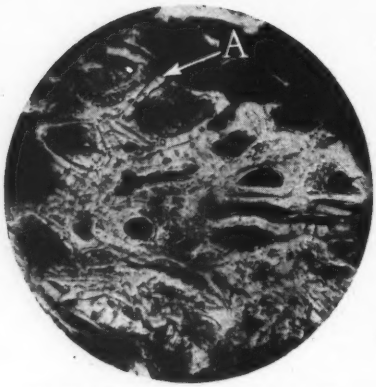

Fig. 407.—Section of one-part moulding showing hardwood particle. Mag. 200 diameters.

incidentally also contains numerous bubbles. The contents of the medullary cells, on the other hand, do not present this granular appearance but show the general characteristics of immature wood.

The tracheid structure of this particle is interesting inasmuch as it illustrates several tracheid ends and shows the general effect of the structure on the filling of the tracheids. Thus tracheid B contains a large blank area at C, which is due to the presence of trapped air being compressed as the resin entered the unit from either end; similar occurrences on a smaller scale may be distinguished elsewhere in the structure of the particle.

Particles of this type showing immature wood make up about 70 per cent. of the content of the wood flour in this moulding, but it is doubtful whether the presence of this material has any great effect on the strength of the moulding, except perhaps in so far as the electrical properties are concerned.

Being of post-war origin, this moulding contains a mixed wood flour, i.e., the filler was a mixture of soft and hard woods. This is not unusual, as during the immediate post-war period the customary softwood flour was in short supply, in consequence of which wood flours containing a percentage of hardwood, usually beech, were used. This gives rise to an interesting problem in the identification of the hardwood amongst the softwood particles. Whereas in the ordinary way there is not a great deal of difficulty in distinguishing the one from the other, when they are incorporated as constituents of a finished moulding the difficulties are increased somewhat as allowances have to be made for masking effects due to the presence of resin and pigment or dye, as well as possible morphological changes brought about by the moulding operation.

A typical example of a hardwood particle in the moulding under consideration is shown in Fig. 407. We are fortunate in this material in so far as the pressure and/or viscosity of the resin appears to have been lower than usual, as is evidenced by the generally good preservation of the wood structures throughout the material. Thus the particle in question shows little, if any, collapse, particularly as seen by the large vessels A at the top of the photograph. There are signs of collapse at the bottom of the particle, but this is probable due to partial disintegration of the cells in the first instance, the structure above is so well preserved as to make very little doubt of the identification.

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Resin treatments to improve the wear resistance of sole leather have recently been developed at the National Bureau of Standards in the United States. In addition to increasing abrasion resistance, the amount of tanning materials was also reduced. Three methods have been developed, one using n-butyl methacrylate monomer, subsequently polymerizing in situ. In the second method a partially polymerized liquid resin is used; guttapercha, a variety of natural rubbers, synthetic elastomers, and acrylate solution polymers have been tried. Thiokol LP-2 was used in the third method. (J. Res. Nat. Bur. Standards, 1949/42/63; Tech. News Bulletin, 1949/Mar./36.)

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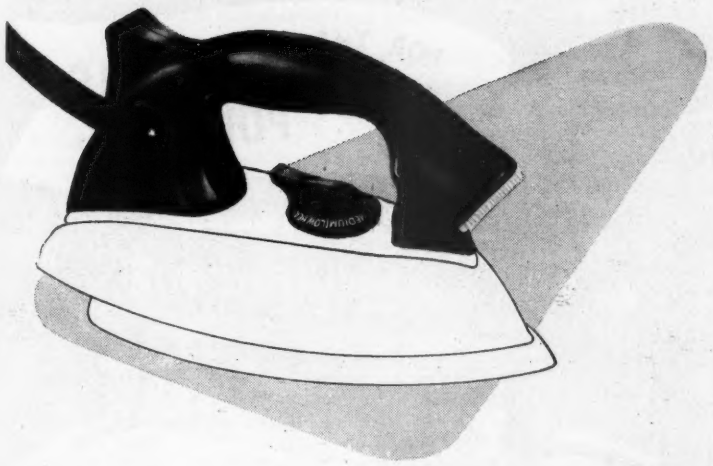

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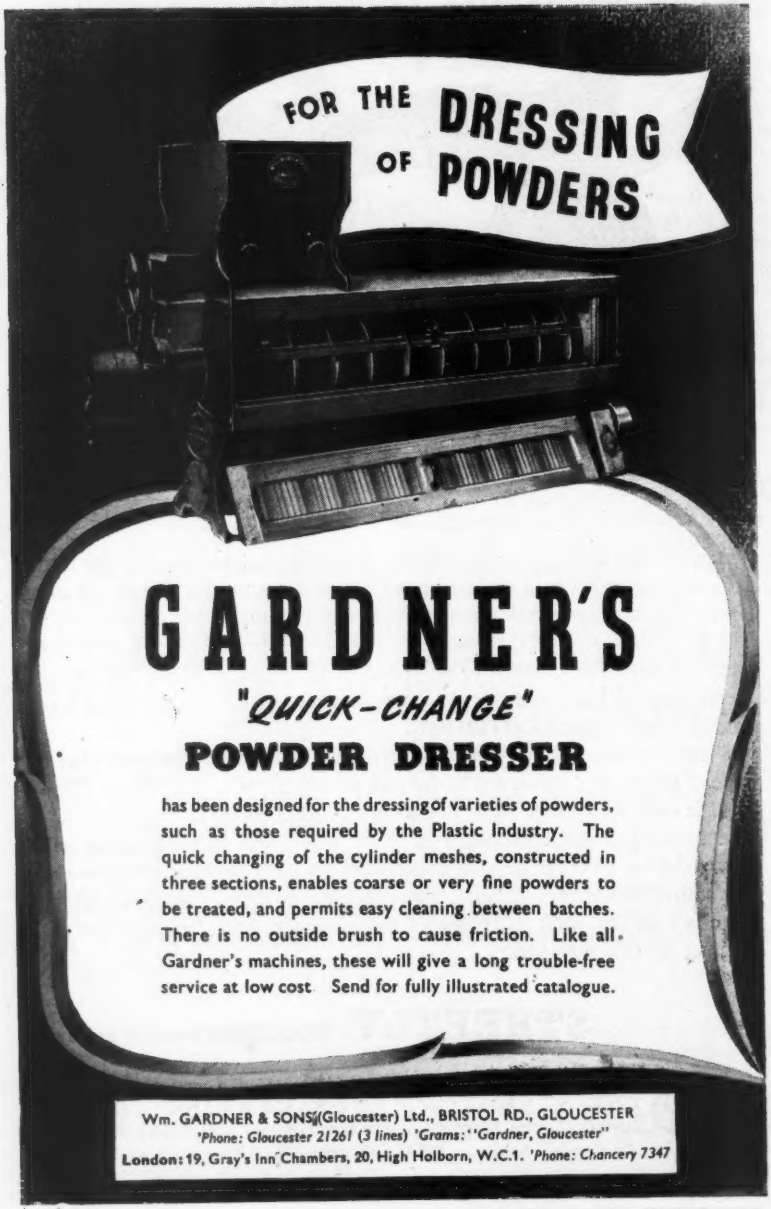
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PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 615,223. Appl. 22.1.46. Conv. (Switzerland) 24.1.45. Acc. 4.1.49.
Manufacturing in a Mould of Polymerized Products. To: Chemische Fabrik Schoneweerd H. Erzinger A.G.
Manufacture of polymerized products in a mould subjecting the mould to a swinging or rotary movement whilst the fluid monomer passes through stage 1 of the polymerization process.

B.P. 615,229. Appl. 31.1.46. Conv. (U.S.A.) 2.2.45. Acc. 4.1.49.
Production of Synthetic Rubber. To: Phillips Petroleum Co.
Refers to butadiene-styrene rubbers improved by adding a blend of tertiary aliphatic mercaptans.

B.P. 615,241. Appl. 26.3.46. Conv. (U.S.A.) 31.3.45. Acc. 4.1.49.
Resin Compositions and Adhesives. K. C. Eberly. To: The Firestone Tyre and Rubber Co. Vinyl chloride copolymer compounded with tetraethylene pentamine.

B.P. 615,246. Appl. 30.3.46. Conv. (Netherlands) 2.3.43, 13.1.44. Acc. 4.1.49.
Methods of Producting Composite Plates or Sheets. H. F. Waards.

B.P. 615,256. Appl. 10.6.46. Acc. 4.1.49.
Polyvinyl Chloride Compositions, their manufacture and application. A. Duerden and C. P. Herd.
Polyvinyl chloride butadiene acrylonitrilecopolymer composition plasticized with one or more polymeric esters derived from an ethylene, propylene or butylene glycol and an alkane alpha-omega-dicarboxylic acid.

B.P. 615,332. Appl. 28.1.46. Conv. (U.S.A.) 30.1.45. Acc. 5.1.49.
Plasticized Resins To: Bakelite, Ltd.
Refers to a substantially non-porous plasticized composition comprising a phenol-aldehyde, urea-aldehyde or melamine-aldehyde type resin plasticized with polymerized acrylo-nitrile.

B.P. 615,343. Appl. 2.5.46. Conv. (Italy) 7.7.43. Acc. 5.1.49.
Sliding Clasp Fastenings of Thermo Plastic Material. To: S.P.A. Lavorazione Materie Plastiche.

B.P. 615,347. Appl. 22.5.46. Acc. 5.1.49.
Moulded Hermetically Sealed Containers. E. A. Fielding, L. Rollin and S. Thorn. To: General Electric Co., Ltd.
Refers to polythene or polystyrene containers for piezo-electric crystals.

B.P. 615,363. Appl. 31.7.46. Acc. 5.1.49.
Manufacture of Polymeric Nitrogen containing Compounds. G. D. Buckley and N. H. Ray. To: Imperial Chemical Industries, Ltd.

B.P. 615,370. Appl. 2.8.46. Acc. 5.1.49.
Production of Poly-pentaerythritols. S. F. Marrian and A. McLean. To: Imperial Chemical Industries, Ltd.

B.P. 615,385. Appl. 7.8.46. Conv. (France) 13.8.45. Acc. 5.1.49.
Polymers. J. Downing. To: British Celanese, Ltd.
Relates to polymers and in particular to the recovery of waterinsoluble polymers (vinyl polymers) from aqueous emulsions.

B.P. 615,488. Appl. 18.6.46. Acc. 6.1.49.
Preparation of Novolak-Resins. E. G. K. Pritchett and G. Barnett. To: Bakelite, Ltd.

B.P. 615,520. Appl. 4.5.45. Acc. 7.1.49.
Polymeric Materials. E. F. Izard. To: E.I. Du Pont de Nemours and Co.

B.P. 615,605. Appl. 18.12.46. Acc. 7.1.49.
Manufacture of Hollow Balls made of Celluloid and the like plastic material. S. W. Snell. To: Halex, Ltd.

B.P. 615,723. Appl. 23.8.45. Acc. 11.1.49.
Resin Emulsions. To: Shawinigan Chemicals, Ltd.
Refers to water resistant coatings or films made by polymerization of vinyl acetate in aqueous emulsion.

B.P. 615,865. Appl. 16.8.46. Conv. (U.S.A.) 16.4.46. Acc. 12.1.49.
Method of Regenerating Vulcanized Copolymers. To: Wingfoot Corporation.
Refers particularly to butadiene styrene copolymers.

B.P. 615,884. Appl. 3.8.39. Acc. 13.1.49.
Manufacture of Linear Nitrogen containing Polymers. H. Dreyfus.
Polymer produced by reacting a bis-chloroformic ester of a polymethylene glycol with a polymethylene diamine.

B.P. 615,954. Appl. 22.8.46. Acc. 13.1.49.
Manufacture of New Polyamides. E. Ellery. To: Imperial Chemical Industries, Ltd.

B.P. 615,985. Appl. 22.1.46. Conv. 24.1.45. Acc. 14.1.49.
Method for Building up Polymerization Products in a Mould. To: Chemische Fabrik Schonenwerd H. Erzinger A.G.

Refers to the production of plates or sheets by polymerization within a mould comprising two plates and unyielding spacing members disposed between the plates. Polymerization is carried out in two stages. The spacing members are replaced by smaller ones once stage 1 of the polymerization process is completed.

B.P. 615,968. Appl. 27.8.46. Acc. 13.1.49.
Combs. J. Johnston. To: Universal Plastics, Ltd.

B.P. 616,026. Appl. 21.8.46. Acc. 14.1.49. (Addition to B.P. 598,023.)
Adhesive Compositions. To: B.B. Chemical Co., Ltd.

Adhesive composition comprising dispersed particles of a resinous material—neoprene composition wherein the neoprene is dissolved in the resinous material (Burgundy pitch or polymerized terpene acids) whilst the latter is molten and the resultant composition dispersed in an aqueous liquid.

B.P. 616,044. Appl. 22.8.46. Acc. 14.1.49.
Manufacture of Aromatic Vinyl Hydrocarbons and Oils. W. T. C. Hammond and L. E. Wakeford. To: Lewis Berger and Sons, Ltd.

B.P. 616,073. Appl. 26.8.46. Conv. (U.S.A.) 28.8.45. Acc. 17.1.49.
Vinylfluorenes and methods of preparing the same. To: British Thomson-Houston Co., Ltd.

B.P. 616,115. Appl. 28.8.46. Acc. 17.1.49.
Joints for Pipes made of Thermoplastic Materials. G. C. Tyce. To: Imperial Chemical Industries, Ltd.

B.P. 616,134. Appl. 28.8.46. Conv. (U.S.A.) 28.8.45. Acc. 17.1.49.
Polymers and Co-polymers of 2-Vinyl Fluorene. To: British Thomson-Houston Co., Ltd.

B.P. 616,197. Appl. 29.8.46. Acc. 18.1.49.
Manufacture of Vinyl Ethers. E. J. Gasson, D. C. Quin and F. E. Salt. To: Distillers Co., Ltd.

B.P. 616,256. Appl. 20.3.45. Acc. 19.1.49.
Mixtures of Polyoxyalkylene Monohydroxy Compounds and methods of making such mixtures. To: Carbide and Carbon Chemicals Corporation.

B.P. 616,260. Appl. 19.6.45. Conv. (U.S.A.) 30.12.43. Acc. 19.1.49.
Catalysts for Polymerization and Condensation of Hydrocarbons. B. B. Corson and L. J. Brady. To: Koppers Co., Inc.

Refers to the use of iron-phosphate catalysts.

B.P. 616,282. Appl. 16.1.46. Conv. (U.S.A.) 26.12.44. Acc. 19.1.49.
Stabilized Films comprising Vinyl Resins and methods of stabilizing such films. K. C. Eberly. To: Firestone Tyre and Rubber Co.

Self-containing vinyl chloride film containing a butadiene copolymer stabilized with a tetra-alkyl-thiuram disulphide.

B.P. 616,291. Appl. 20.3.46. Conv. (U.S.A.), 16.3.40. Acc. 19.1.49.
Artificial Resinous Materials and preparation thereof. To: Pittsburgh Plate Glass Co.

Preparation of an artificial resin by heating a drying oil or a drying oil fatty acid and a dicyclopentadiene in a closed vessel until a copolymer soluble in hydrocarbon thinners is formed.

B.P. 616,315. Appl. 4.7.46. Acc. 19.1.49.
Production of Cellular Products from Plastic Materials. To: Lewis Berger and Sons, Ltd.

Cellular plastic materials produced by using biuret as a blowing agent.

B.P. 616,320. Appl. 8.7.46. Conv. (U.S.A.). 10.7.45. Acc. 19.1.49.
Tetra-Allyl-Silane and Polymers thereof. To: British Thomson-Houston Co., Ltd.

B.P. 616,337. Appl. 4.3.43. Acc. 20.1.49.
Synthetic Resins. T. Urbanski and H. J. Poole. To: Ministry of Supply.

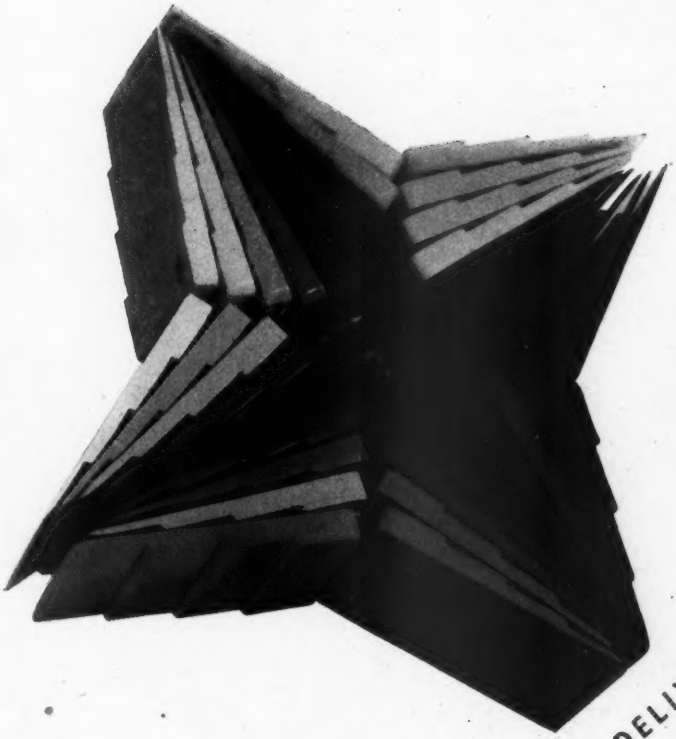
Production of a thermoplastic self-combustible synthetic resin by condensing phenyl nitromethane or a homologue thereof with formaldehyde in the presence of ethylene diamine.

B.P. 616,436. Appl. 31.8.46. Acc. 21.1.49.
Apparatus for Radio Frequency Heating. D. Jackson. To: Pye, Ltd.

B.P. 616,440. Appl. 2.11.46. Acc. 21.1.49.
Process for Dyeing. A. S. Fern, C. A. Pulley and S. M. Todd. To: Imperial Chemical Industries, Ltd. Relates to a process for dyeing acrylo nitrile polymers with vat dyestuffs of the anthraquinone, indigo, thioindigo and related series.

B.P. 616,443. Appl. 2.9.46. Acc. 21.1.49.
Production of Polyamides. S. J. Allen, J. G. N. Drewitt and F. Bryans.

B.P. 616,453. Appl. 4.9.46. Acc. 21.1.49.
Production of Nitropolystyrene. H. Zenftman and A. McLean. To: Imperial Chemical Industries, Ltd.



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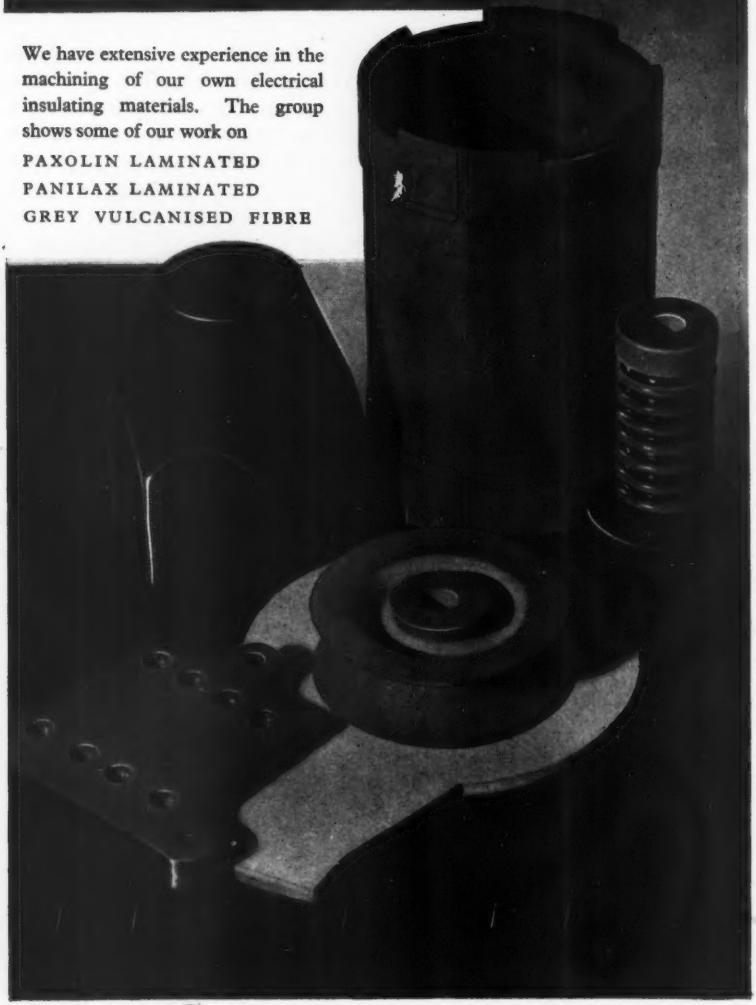

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B.P. 616,488. Appl. 6.9.46. Conv. (U.S.A.) 6.9.45. Acc. 21.1.49.

Film Forming Blends of Polymeric Materials. To: E. I. Du Pont de Nemours and Co.

Film-forming composition containing at least 60 per cent. of an ethylene polymer and a polymethylene of specified melting point, bending modulus and permeability value.

B.P. 616,549. Appl. 26.4.46. Acc. 24.1.49.

Treatment of Nylon Thread. J. W. Illingworth and G. S. Deutsch. To: Dunlop Rubber Co., Ltd.

B.P. 616,742. Appl. 10.9.46. Acc. 26.1.49.

Production of Improved Moulding Powders from Aldehyde Resins and Acid-treated Fibres. H. W. Chatfield.

A moulding composition comprising the resinous condensation product of an aldehyde with a substance capable of condensing therewith to form a resin of wool fibres which have been treated with mineral acid.

B.P. 616,751. Appl. 11.9.46. Conv. (Canada) 24.9.45. Acc. 26.1.49.

Direct Production of Aromatic Vinyl Compounds and Polymers thereof. To. Dominion Tar and Chemical Co., Ltd.

B.P. 616,897. Appl. 18.9.46. Acc. 28.1.49.

Improvements in Containers. F. M. Menheneott. To: Betts and Co., Ltd.

A method of forming a container which comprises coating a mandrel with a lubricant, dipping the mandrel at least once in a non-metallic plastic material in fluid form whereby a receptacle of plastic material having one end closed is formed on the mandrel. Remove the receptacle and secure a rigid neck in the open end thereof.

B.P. 616,927. Appl. 29.9.45. Conv. (U.S.A.) 21.9.45. Acc. 28.1.49.

Hydrolysed Interpolymers of Vinyl Fluoride with Vinyl Esters. To: E. I. Du Pont de Nemours and Co.

B.P. 616,996. Appl. 30.9.45. Acc. 31.1.49.

High Frequency Dielectric Welding. A. J. Maddock and K. M. Burtt. To: Standard Telephones and Cables, Ltd.

A method of welding a dielectric object, consisting of placing it in a wave guide carrying electromagnetic waves so that the object absorbs energy from such waves.

B.P. 617,052. Appl. 27.9.46. (Addition to B.P. 571,814 dated 17.3.42.) Acc. 31.1.49.

Process for preparation of Polymerized Ethylene in Powder Form. H. F. Wilson and B. Allwright. To: Telegraph Construction and Maintenance.

Process for preparing polymerized ethylene in powder form as claimed in common with the claims of the part Specification No. 571,818, characterized by colouring the polymerized ethylene prior to precipitation so that a coloured precipitate is obtained.

B.P. 617,266. Appl. 24.4.46. Conv. (U.S.A.) 20.11.45. Acc. 3.2.49.

Manufacture of Variegated Plastic Sheet Material. To: Armstrong Cork Co.

A method of making variegated plastic sheet material which comprises extruding a mixture of ground and variegating coloured compositions into mottle-coloured rods, feeding a mass of such rods into the nip of a sheeting calender with the length of the rods generally parallel to the axes of the calender rolls and in such a manner to maintain a bank of such rods in the nip and compressing the mass of mottle-coloured rods into the nip and through the calendered rolls to unite the rods into a variegated sheet.

B.P. 617,285. Appl. 10.9.46. Conv. (U.S.A.) 12.9.45. Acc. 3.2.49.

Recovery of Polymers from Aqueous Dispersions thereof. To: British Celanese, Ltd.

This invention relates to the treatment of emulsions of polymers or co-polymers of styrene or derivatives of styrene and relates more particularly to the precipitation of such polymers from said emulsions, in a highly stable form capable of yielding clear colourless moulded products.

B.P. 617,311. Appl. 26.9.46. Conv. (U.S.A.) 27.9.45. Acc. 3.2.49.

Hydrogenated Polymers. To: British Thomson-Houston Co., Ltd.

Method of raising the softening point of a thermoplastic polymer of a monovinyldibenzofuran which consists in hydrogenating the polymer.

B.P. 617,319. Appl. 11.12.46. Acc. 3.2.49.

Automatic Control Systems for High Frequency Dielectric Electrical Heating Installations. G. Briggs.

B.P. 617,335. Appl. 22.10.45. Conv. (U.S.A.) 9.11.44. Acc. 4.2.49.

Vinyl Chloride and process for preparing the same. J. A. Bralley. To: B. F. Goodrich.

A process of preparing vinyl chloride which comprises reacting acetylene with hydrogen chloride in the presence of a previously prepared catalyst comprising as an essential component a bivalent mercury compound in which one of the valences of the mercury is specified by a beta halovinyl group and the remaining valence is specified

by halogen or another beta halovinyl group.

B.P. 617,396. Appl. 30.9.46. Conv. (U.S.A.) 28.9.45. Acc. 4.2.49.

Apparatus for Heating Dielectric Materials Electronically. To: Radio Corporation of America.

Relates to apparatus for heating dielectric materials electronically and more particularly to the heating of moisture-laden dielectric articles to expel moisture therefrom.

B.P. 617,508. Appl. 27.12.45. Conv. (Netherlands) 29.9.45. Acc. 8.2.49.

Compositions comprising Halogen-containing High Molecular Substances. To: N. V. de Bataafsche Petroleum Maatschappij.

Discloses a method of producing sheets composed of vinyl chloride, vinylidene chloride copolymers which do not discolour when heated. This is achieved by compounding the copolymers with tetrahydronaphthalene hydroperoxide.

B.P. 617,570. Appl. 7.10.46. Conv. (U.S.A.) 8.11.45. Acc. 8.2.49.

Producing Foils and Films of Polymeric N-Vinyl Pyrrole Compounds. M. T. Ozinik. To: General Aniline and Film Corp.

B.P. 617,580. Appl. 7.10.46. Conv. (France) 5.11.45. Acc. 8.2.49.

Hair Curler. H. Rust.

P.V.C. or rubber hair curler comprising a ring from rubberlike material and a peg as clamping means.

B.P. 617,620. Appl. 2.5.46. Acc. 9.2.49.

Stabilized Compositions containing Polymers which evolve Hydrogen Chloride on decomposition. P. G. Croft-White and P. J. Garner. To: N. V. de Bataafsche Petroleum Maatschappij.

Stabilization of halogen containing polymers by compounding the same with a salt derived from a nuclear salicylic acid and from a metal which does not promote decomposition.

B.P. 617,632. Appl. 26.7.46. Acc. 9.2.49.

New Synthetic Resinous Compositions. E. M. Evans and J. F. Williams. To: British Resin Products, Ltd.

Surface coating compositions containing a reaction product of a polybasic acid or of an anhydride thereof, with the esterifiable condensation product of formaldehyde with a saturated enolizable ketone.

B.P. 617,779. Appl. 15.1.46. Acc. 11.2.49.

After-treatment of Copolymers. To: Standard Oil Development Co.

Relates to styrene isobutylene copolymers.

B.P. 617,820. Appl. 9.10.46. Conv. (Switzerland) 19.10.45, 12.9.46. Acc. 11.2.49.

Manufacture of Dichlorovinyl Ethers. To: Ciba, Ltd.

B.P. 617,891. Appl. 31.12.45. Conv. (Netherlands) 28.8.45. Acc. 14.2.49.

Manufacture of Copolymerization products of Homogeneous Composition. To: N. V. de Bataafsche Petroleum Maatschappij.

B.P. 617,898. Appl. 18.2.46. Acc. 14.2.49.

Manufacture of Artificial Eyes. A. Kingston.

Manufacture of artificial eyes from acrylic plastics by welding together two preformed (moulded) parts containing between them an iris disc.

B.P. 617,907. Appl. 17.4.46. Acc. 14.2.49.

Manufacture of Aqueous Dispersions of Synthetic Linear Polyamides. To: Imperial Chemical Industries, Ltd.

B.P. 617,985. Appl. 4.7.46. Acc. 15.2.49.

Compounding, Mixing and Sheeting of Plastic Materials. S. A. Ede. To: James Ferguson and Sons, Ltd.

B.P. 618,094. Appl. 18.10.46. Conv. (U.S.A.) 19.10.45. Acc. 16.2.49.

Plastic Composition containing Glass Fibre. To: E. I. Du Pont de Nemours and Co.

B.P. 618,124. Appl. 23.10.46. Acc. 16.2.49.

Moulding of Synthetic Resin Sheets. R. A. Kinnear. To: Imperial Chemical Industries, Ltd.

B.P. 618,168. Appl. 30.10.46. Acc. 17.2.49.

Polymerization of Compounds containing the Ethylenic Double Bond. I. Marshall, I. Harris, K. B. Garrett. To: Imperial Chemical Industries, Ltd.

Polymerization of ethylenically unsaturated compounds in the presence of esters of hyponitrous acid.

B.P. 618,175. Appl. 30.10.46. Conv (U.S.A.) 30.10.45. Acc. 17.2.49.

Production of Polyvinyl Amine Compounds. D. D. Reynolds and W. D. Kenyon. To: Kodak, Ltd.

B.P. 618,197. Appl. 1.11.46. Acc. 17.2.49.

Shaping Cellular Products made of Artificial Resins. M. Goldstaub. To: Dunlop Rubber Co., Ltd.

Shaping of thermosetting phenol-formaldehyde resin products by softening a mass of solvent sensitive porous thermo-setting phenol-formaldehyde resin by treatment with steam and deforming the softened product.

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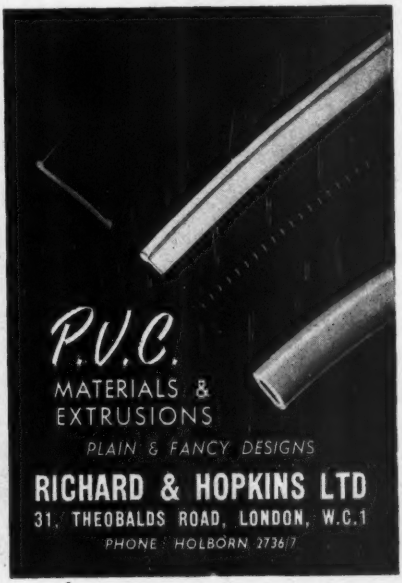

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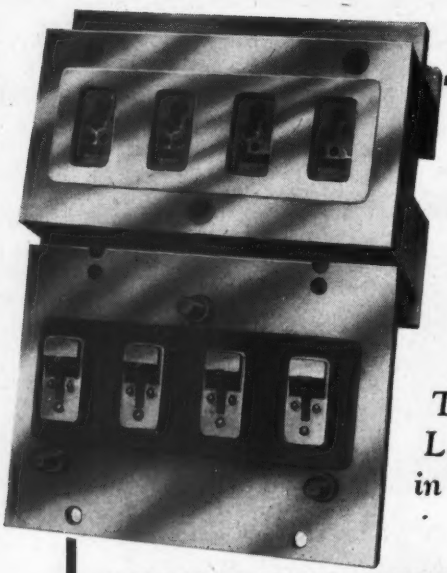

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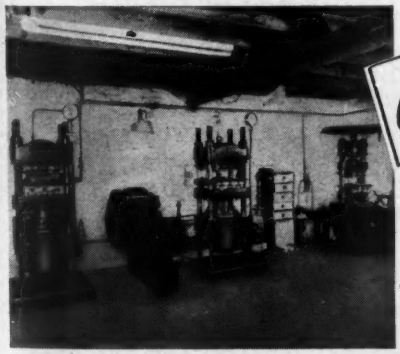

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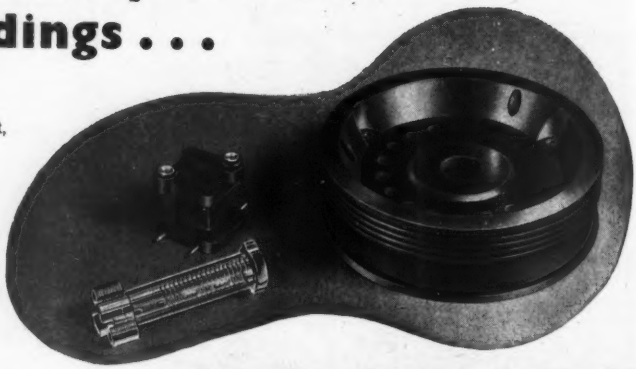

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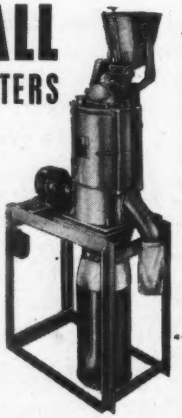

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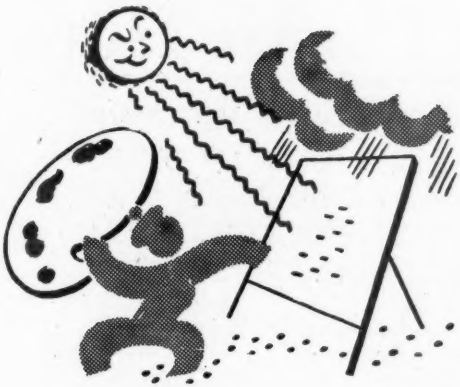

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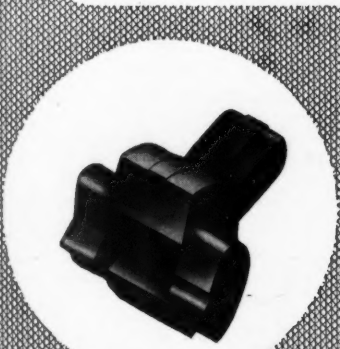

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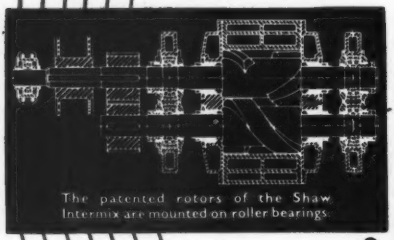

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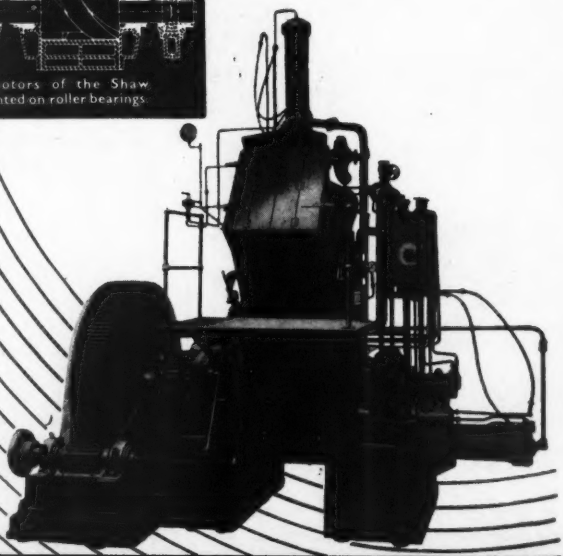

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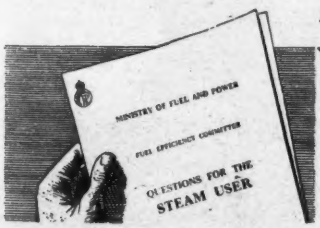

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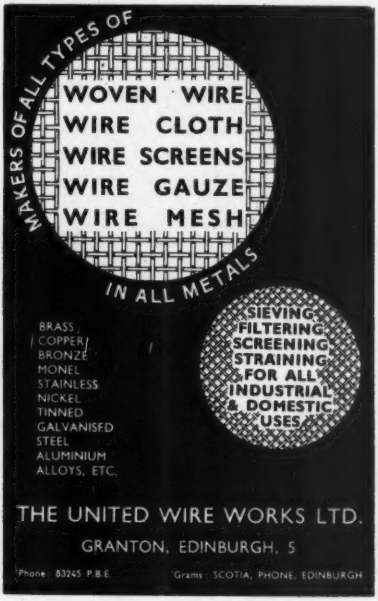

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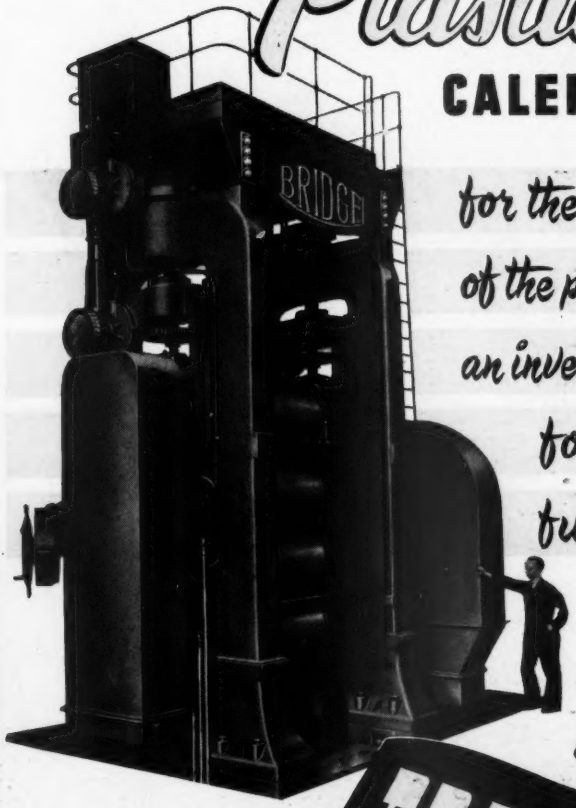

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(WRITE DEPT. A)

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the development of a new and ultimately wide range of special purpose HOSE and HOSE CONNECTIONS in P.V.C. and Polythene, or in a combination of both.

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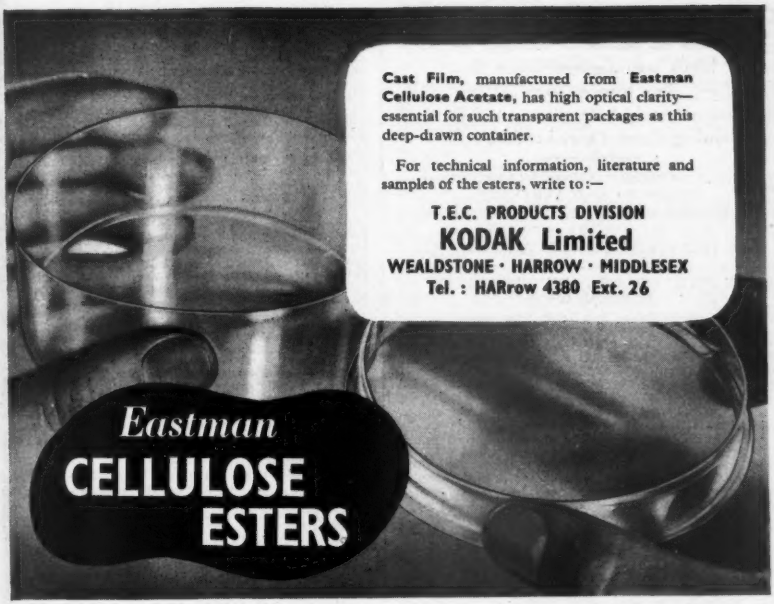
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Phone, Temple Bar 7471 (four lines).
zzz-250

—— DESIGN AND DRAWING ——

Design and drawing capacity for plastic moulds (injection, compression, transfer), and component design development. Graystone Designs, 35 Winchester Road, Hampstead, N.W.3. Phone, Pri 7420. zzz-255

—— MACHINERY, TOOLS AND PLANT ——

Alternators, Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings, ex stock. Keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

Plaster Casting improved by new flexible mould Dohm, Ltd., 167 Victoria Street, S.W.1. 146-735

Iddons extrusion press, motorized A.C. 415/3/50. Rosedown hydraulic pump, model B.11, 3-throw, 2-stage, 2 tons sq. inch, with 15 h.p. motor 415/3/50 and Igranic starter.
Shaw hydraulic accumulator, 100 tons cast iron weight, loaded type, with three-throw pumps, motor A.C 415/3/50, latest design, as new. Two Shaw hydraulic presses, 60 tons, four columns, platens 3 ft. 6 ins. by 4 ft., daylight 6 ft. 6 ins., as new.
Ingersoll Rand horizontal compressor, 100 cubic ft. per minute, motor A.C. 415/3/50.
W. Urquhart, 1023-1027 Garratt Lane, S.W.17. 147-978

Full steam in five minutes with B. and A. Electrode Boilers, used by British industries for 20 years. No boiler-house, no flue, no attendant needed. The most compact and convenient steam raisers available. Can go beside machines using the steam. Write for leaflet 118, Bastian and Allen, Ltd., 11 Bedford Square, W.C.1. 146-979

Twelve plating vat rumblers by Cruickshank, 18-in. diam. by 21 ins. deep, belt driven, £25 each. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14. zzz-254

The following plastic injection moulding machines are for immediate sale: 2 T.M.A. E.L.9 machines, 2-oz. capacity, complete with Reavell compressor, air bottles, 25 h.p. motor and all accessories; also one T.M.A. S.H. 3-oz. semi-automatic injection moulding machine and one T.M.A. S.H.6 6-oz. capacity injection moulding machine, as new; also one Wickman p.v.c. moulding machine, as new. All these machines are in perfect working order and are in first-class condition throughout. All have had little use and are surplus to manufacturing requirements. Keen price for quick sale. Box P463, care of "Plastics." 146-2

¾ g. Westminster injection machine, 8-in. Christy and Norris grinding mill, motorized, 3/50/415.
Two dental-type plastic presses, 5-in. square, electrical-heated platens, screw-down, heavy coil spring, pressure to 6,000-lb. pressure.
Electric oven, internal measurement 10 ins. by 7 ins. by 7 ins., thermostat control —+2 degrees to 150 degrees C.
Quantity plastic scrap, used once, acetate and polystyrene, also virgin acetate.
Small plating plant, generator, motor, vats, materials, not for chrome. T. M. Ryalls, Avon Street, St. Annes-on-Sea. Phone 1009. 146-x80641

Small injecting moulding business, fully equipped, hand-operated machine, grinding mill, tool shed, etc., good orders, N.W. Coast town. Box P465, care of "Plastics." 146-x8064

Small injection moulding plant, comprising four 1½-oz. air-operated moulding machines, with necessary compressor plant. All details and inspection under working conditions at M. Myers and Son, Ltd., Vicarage Street, Oldbury, near Birmingham. 146-14

Machinery, Tools and Plant (contd.)

Francis Shaw 10-grm. hand-injection machine for sale with imitation leather-cloth button mould. Box P4614, care of "Plastics." 146-15

High-speed routing machines by Wadkin for sale, model LE with radial arm suitable for wood, metal or plastics, speed of head 24,000 r.p.m., radius of arm 66 ins. with rise and fall head, frequency changer, suitable for 400 volts, 3 phase, 50 cycles. F. J. Edwards, Ltd., 359 Euston Road, London, N.W.1. Euston 4681. 146-19

"Impetus" machinery, ex stock, belt grinders or sanders, 4-in. band, £7, motorized £15 10s.; also 6-in. model; 13-speed motorized ½-in. drilling machines, £18 10s.; exhaust fans, air compressors, paint spray plants, etc.; catalogue from manufacturers. John P. Steel, Dept. 8, Bingley, Yorks. zzz-267

200-ton Bradley and Turton downstroke hydraulic press, electrically heated platens.
Bradley and Turton 5 h.p. A.C. motor-driven cable plunger hydraulic pump and dead-weight accumulator.
½-oz. horizontal injection moulding press, compressed air, toggle motion.
Two Manesty R.D.3 pelleting machines, 16 plungers, 15/16-in. diameter, 3 h.p., A.C., motor driven.
Available for immediate delivery. Hubert Jones, Ltd., Cobden Street, Salford, 6. Phone, Pendleton 1373-4. 146-22

Cambridge recorders with Pyrometers, one 0-600 degrees C., one 0-400 degrees C. Pyrex glass distillation unit with condenser, suitable for laboratory. Eastern Plastics, Sungate House, Collier Row Road, Romford, Essex. 146-x9276

Shaw hydraulic accumulator, 120 tons cast iron weight loaded type with three throw pumps, not A.C. 415/3/50, latest design, as new.
Two Daniels semi-automatic pre-filling hydraulic presses, 75 tons, electric-heated platens 17 ins. by 14 ins., thermostat control.
Two Shaw hydraulic presses, 60 tons, four columns, platens 3 ft. 6 ins. by 4 ft., daylight 6 ft. 6 ins., as new.
Ingersoll-Rand horizontal compressor, 100 cubic ft. per min., not A.C. 415/3/50.
W. Urquhart, 1023-1027 Garratt Lane, S.W.17. Bal 3351. 152-1125

—MACHINERY, TOOLS AND PLANT WANTED —

Wanted: Injection-moulding machine, 2- or 3-oz. capacity. Full details and price to Box No. 157, Nevin D. Hirst (Adv.), Ltd., 23 Mount Preston, Leeds, 2. 148-1057

Hydraulic presses. Advertiser is interested in renting hydraulic press (presses), capacity 150-250 tons, electric platens, 24 ins. by 36 ins. approximately, daylight, 12 ins. approximately, self-contained if possible, i.e., no accumulators, e.g., fitted with Fraser-type pump. Reply Box P463, care of "Plastics." 146-3

Wanted, moulds made for small comb with 11 large teeth, size 2 ins. by 1½ ins., for hand-operated injection machines. Estimate to Futcher, 3 Heron Court Road, Bournemouth. 146-x95741

Wanted, second-hand injection machine, hand operated, 10 gm Westminster or Nene Valley Details and price, Futcher, 3 Heron Court Road, Bournemouth. 146-x9574

8-oz. injection machine required, must be in first-class condition, hydraulic system essential. Box P4617, care of "Plastics." 148-1124

PRODUCTION CAPACITY AVAILABLE AND WANTED

Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 149-543

Printing, engraving, etc., on all types of plastics. Modern Plastics, Ltd., Kangley Bridge Road, S.E.26. 148-929

Fairman Precision Tools and Products, Ltd., of Horley, Surrey, have capacity for the manufacture of bakelite and plastic moulds, diecasting dies, press tools and special purpose machines. Also all classes production machining. Phone, Horley 909. 148-936

P.V.C. silk screen printing, Table cloths, curtains, nursery patterns, etc. Capacity available or quantity runs. Quality work. Daily deliveries. Guaranteed adhesion and fastness of colour. Davis (Patents), Ltd., 18 Phipp Street, London, E.C.3. Bishopsgate 2939, 5091. 146-980

Injection moulding by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 148-0927

Gold blocking on Perspex, acetate, leather, etc. G. B. Smith and Co., 84 Highbury Park, London, N.5. Phone, Canonbury 1407. 148-x8911

Dohm, Ltd., pulverize raw materials everywhere. 167 Victoria Street, London, S.W.1. zzz-259

Cellulose acetate-dipping process: Will firms with available capacity and plant for mechanical dipping small objects please communicate with Managing Director, Box P469, care of "Plastics." 146-x8912

Production Capacity Available and Wanted (contd.)

Moulding capacity now available, injection up to 8 oz., compression up to 100 ton. W. E. Amies and Co., Ltd., Gatefield Works, Robert Street, Sheffield, 6. 146-12

Injection moulders desire to rent or hire 3-, 4- or 6-oz. injection moulding machine, possible purchase later. Box P4611, care of "Plastics." 146-13

We are able to undertake certain short or long runs of highly specialized medical and technical plastic moulded products, injection, compression or sheet fabrication, use our services for the preparation of prototypes; all inquiries strictly confidential. Box P4613, care of "Plastics." 148-1123

Injection mouldings in therm-plastics. Mouldings in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtenay, Ltd., 138 Stratford Road, Birmingham, 11. 146-30

"Impossible" moulding propositions invited by pioneer injection moulders with unusually qualified staff and most modern capacity up to 12 oz. Inquiries in strict confidence and without obligation. Box P4515, care of "Plastics." 146-27

—RAW MATERIAL AVAILABLE AND WANTED—

Cork! Cork! —British Cork Mills, Ltd., 167 Victoria Street, London, S.W.1. Vic 1414-6. zzz-238

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeye, Ltd., 188a Seven Sisters Road, London, N.7. 151-634

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Have available from stock all thickness in clear and colour flat sheet cut to customer's sizes.
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Perspex! Perspex! Perspex!!! Official stockists for I.C.I acrylic sheet. Sheets cut to your requirements. Fabrication and mounting specialists to the trade:— S. C. Errington (Hanwell), Ltd., 132a Uxbridge Road, Hanwell, London, W.7. Phone, Ealing 5288. zzz-251

Always large stocks of
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PERSPEX
sheets up to 1-in. thick.
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Reclaimed X-ray sheet, blue tinted, 10 tons available in sizes approx. 6 ins. by 4 ins. to 12 ins. by 10 ins. at 1s. per lb.; minimum 1 ton lots. Larger sizes available at slightly higher rates.
Reclaimed nitrate X-ray sheet, blue and clear, 5 tons available at 1s. per lb.
Plastic scrap, very mixed assortment, colours and shapes, 3d. per lb. in 1 ton lots, 5 tons available.
Acetate flakes, clear, transparent, 6d. per lb. in 1 ton lots.
Clear transparent acetate sheet film, 10 ins. by 6 ins., 10 thou. thick, brand-new material, 2s. 9d. per lb. in 1 ton lots.
Transparent "Celastoid" sheets, 24 ins. by 27 ins. and 24 ins. by 54 ins. by .015 in. thick; pink, blue and green, 2s. 9d. per lb.; 5 cwt. available.
Opaque "Celastoid" sheets, 24 ins. by 27 ins. and 24 ins. by .015 in. thick; pink, cream and blue, 2s. 9d. per lb.; ½ cwt. available.
250 acetate sheets, blue, 56 ins. by 25 ins. by 20 thou. thick, 10s. per sheet.
Crystal celluloid and acetate sheets, approx. 24 ins. by 20 ins. by .003 in., with light imprint. Approx. 1 ton available at 9d. per lb.
Lloyd's, 4-9 Church Street, Christchurch. Phone, Christchurch 504. zzz-252

Production Capacity Available and Wanted (contd.)

Tubes in ivory casein. Large quantities at 36s. gross, 10 gns. per 1,000. Length 6¼ ins., outside diameter 1½ ins. or 1⅝ ins., wall thickness 1/16 in. Exchange Elec. Co., 41 Cheetham Hill Road, Manchester, 4. 146-976

Polythene moulding powder (reconstituted) in black natural and a variety of colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-260

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-261

P.V.C. calendering compound in a range of opaque colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-262

"Perspex" 3/16 in., clear and colours, considerable quantity, surplus to our requirements; 10 per cent. off list price. Betterwear Products, Ltd., North Street, Romford, Essex. (Romford 2233.) 146-4

"Perspex" surplus, new large sheets clear material, 1/16 in., 2 mm., 5/16 in., ⅜ in., ½ in. and ¾ in. for sale at discounts up to 20 per cent. off list. P.D.I., Ltd., 54 Snow Hill, Birmingham, 4. Central 5855. 146-5

Virgin polystyrene for sale, translucent red, green and amber, also some reground. Write Box P467, care of "Plastics." 146-6

Clear transparent 40 thou. acetate, sheets 54 by 24. Also blue, green and smoke 60 thou., perfect material, cwt. lots 6s. lb., 5 cwt. 5s., ½ ton 4s. Allans, 37 Farringdon Street, London, E.C.4. Cen 5947. 146-10

Almex, Ltd., Exchange Buildings, Birmingham, offer coloured 1/16-in. I.C.I. Perspex acrylic, clear polystyrene sheets, cable grade P.V.C., ebonite and tufnol sheet and offcuts. All at most favourable prices. zzz-265

Catalin cylinders, rods, sheets and sections approx. 1,500 lb., 4s. lb. Write Box P4610, care of "Plastics." 146-x8969

Buna-plast, a blending of synthetic rubber and P.V.C. specially processed for manufacturing leather substitute; this material is far superior to plasticized P.V.C. Inquiries welcomed. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-258

Polystyrene moulding scrap urgently required; state amount available and send small sample. Box P461, care of "Plastics." zzz-256

Polystyrene reground moulding powder available in limited quantities. Dohm, Ltd., 167 Victoria Street, S.W.1. zzz-263

Accurate industrial powders. Dohm, Ltd., 167 Victoria Street, S.W.1. zzz-264

Virgin cellulose acetate moulding powder in transparent, translucent and opaque colours, three-flow grades, now available from stock at reasonable prices. Dohm, Ltd., 167 Victoria Street, S.W.1. zzz-257

Cellulose acetate or copolymer sheeting wanted, cream, white and transparent, 30 thou. Box P4512, care of "Plastics." 146-25

Coloured "Perspex" scrap and all thermoplastic scraps collected from your works at the best terms. Michael S. Stevens, Ormond Road, Richmond, Surrey. Phone 0211. 146-28

D. H. Ridout and Son, Ltd. Reg. Office, 12 Stedman Road, Southbourne, Bournemouth. Phone, Southbourne 505.
Official stockists for I.C.I. acrylic Perspex, crystal and coloured, and "Crinothene" sheeting in all shades.
Offer acetate and celluloid transparent sheeting from 2s. per lb.
Bakelite laminated sheeting from 1s. 10d. per lb.
Coloured and clear Perspex off-cuts at 1s. 3d. to 2s. per lb., according to gauge and quantity required.
All types of plastic tubes and rod from 4d. per ft.
1¼-in. ribbed plastic belting at 6d. per yd.
Perspex No. 6 and No. 2 quick-drying cements and polishes.
Special offer of 1-oz. and ½-oz. amber bottles with plastic screw stopper at 15s. per gross.
Send for new stock list, which contains numerous interesting items to opticians and manufacturers of finished plastic goods.
Surplus stock purchased.
D. H. Ridout and Son, Ltd., Stedman Road, Southbourne, Bournemouth. 146-29

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene and other thermoplastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. 146-31

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

Sales representative required by oil seal manufacturers, previous experience essential, excellent prospects. Apply Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancs. 146-977

Commercial manager wanted for plastics division of large company selling to engineers. Some manufacturing knowledge desirable, not absolutely necessary. All particulars and salary required to Box P4616, care of "Plastics." 146-18

Sales manager wanted for section of sales organization of large company. Experience in sales and organizing sales staff essential. A knowledge of chemistry and/or engineering an advantage. Age not over 40 years. Apply, giving details of experience and salary required, to Box P4615, care of "Plastics." 146-17

Chemist, age 25 to 30 years, with University degree or equivalent, and some industrial experience, required for research laboratory engaged on the development of plastic sealing compounds, with prospects of becoming head of this department. Preference will be given to an applicant having previous experience on extrusion machinery. Some knowledge of engineering would be an advantage. Salary according to qualifications and experience, minimum £550 gross. Apply, Technical Director, B.B. Chemical Co., Ltd., Ulverscroft Road, Leicester. 146-16

Working foreman required for Bakelite moulding factory, experienced with trade moulders on presses up to 250 tons on fast production preferred. Progressive position. State full details of past experience in date order and salary required. Box P4613, care of "Plastics." zzz-266

Works manager required for modern and well-equipped plastics factory in the London area, employing about 400 people. Applicant must have expert knowledge of thermosetting and thermoplastics moulding operations. He must be a capable organizer and be able to handle industrial relations problems tactfully and successfully. Reply, stating age, training, experience, and salary required, to Box P468, care of "Plastics." 146-11

Francis Shaw and Co., Ltd., Corbett Street, Manchester, 11, require the services of an engineer sales representative in the Birmingham area for their plastic machinery. A knowledge of the rubber industry would be an added advantage. Write to the Welfare Manager. 146-9

Technical assistant, with experience in plastics laboratory work and machine control, required for plant producing plastic insulated cables and mouldings, to assist in the technical control of plasticising and extrusion processes. Commencing salary in accordance with age and experience.
Apply Works Manager, Pirelli-General Cable Works, Ltd., Eastleigh, Hants. 146-7

Chemist, Graduate (female) required for radio-electrical laboratory, W. London district. Please write fully details of age, experience, qualifications and salary required, to Box P4513, care of "Plastics." 146-24

Wanted, foreman for medium-sized injection moulding shop, London, toolmaker an advantage, drive and organizing ability essential; first-class man only. Box P4516, care of "Plastics." 146-26

Francis Shaw and Co., Ltd., Corbett Street, Manchester, 11, require the services of an engineer sales representative in the London area for their plastic machinery. A knowledge of the rubber industry would be an added advantage. Write to the Welfare Manager. 146-8

SITUATIONS WANTED

Injection moulding production foreman, good practical experience, energetic and ambitious, will accept responsibility and produce results. Seeks position North London. Box P466, care of "Plastics." 146-x6991

TIME RECORDERS

Factory time recorders. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., Ltd., 157-159 Borough High Street, S.E.1. 149-0544

MISCELLANEOUS

Packing cases and boxes for all purposes. F. Rawle and Co., Ltd., 71 Kensington Avenue, London, E.12. Phone, Grangewood 2003. 147-441

One-piece calendar sets, celluloid perpetual change dates, engraved nameplates, scales, dials, etc., ivornine. Tickets and Co., Plastic, Leicester. 149-537

Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write Monomarks, BCM/MONO76, W.C.1. 146-736

Miscellaneous (contd.)

Engraved name plates, scales, dials, etc., supplied. Tickets and Co., Box 2, Silver Street, Leicester. 153-824

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Use a Trade Mark. Consult
Trade Mark Protection Society,
12 Church Street, Liverpool. 154-935

Moulds, hard chrome 7-day service. Specialists in chromium, cadmium, nickel plating and polishing. Industrial Plating and Research Co., Ltd., Cowley Mill Road, Uxbridge, Middx. Uxbridge 2858. 147-1058

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SUPPLIES AND SERVICES
PLATING, PRINTING, ENGRAVING,
MOULDING, FABRICATING, SPRAYING
OF PLASTICS AND METALS.
McKENNA AND MOORE, LTD.,
ASHFORD, FORDINGBRIDGE, HANTS. 147-1056

Festival of Britain. The Council of Industrial Design have opened a 1951 stock list to which they invite manufacturers to send photographs or drawings of their best products. Address to: Stock List, Council of Industrial Design, Tilbury House, Petty France, London, S.W.1. 147-1055

Quantity of bakelite cylindrical containers required, approximate size 2½ ins. long, 1-in. diameter. Full details and prices to Box P462, care of "Plastics." 146-1

Rubber bands for all packing purposes. Surrey Rubber Co., Ltd., Church Road, Ashtead, Surrey. 151-1122

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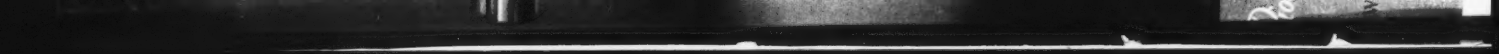

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